[H.N.S.C. No. 104-21]

RESPONSE TO THE LANDMINE THREAT IN BOSNIA

HEARING

BEFORE THE

MILITARY RESEARCH AND DEVELOPMENT SUBCOMMITTEE

JOINT WITH

MILITARY PROCUREMENT SUBCOMMITTEE

OF THE

COMMITTEE ON NATIONAL SECURITY
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

HEARING HELD
JANUARY 24, 1996

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RESPONSE TO THE LANDMINE THREAT IN BOSNIA

HOUSE OF REPRESENTATIVES, COMMITTEE ON NATIONAL SECURITY, MILITARY RESEARCH AND DEVELOPMENT SUBCOMMITTEE, JOINT WITH MILITARY PROCUREMENT SUBCOMMITTEE

Washington, DC, Wednesday, January 24, 1996.

The subcommittee met, pursuant to call, at 2 p.m., in room 2118, Rayburn House Office Building, Hon. Curt Weldon (chairman of the Subcommittee on Military Research and Development) presiding.

OPENING STATEMENT OF HON. CURT WELDON, A REPRESENTATIVE FROM PENNSYLVANIA, CHAIRMAN, MILITARY RESEARCH AND DEVELOPMENT SUBCOMMITTEE

Mr. WELDON. The Subcommittee on Military Research and Development, in joint hearing with the Military Procurement Subcommittee, will come to order. I apologize for the delay.

As most of you are aware, we are doing the Defense Authorization Act version No. 2, 3 or 4, whatever you want to call it, on the House floor today, so many of our colleagues are there and will be joining us in a matter of moments. Mr. Hunter is on his way over, and others, and I apologize for the delay we have caused here.

Today, the Military Research and Development Subcommittee and the Military Procurement Subcommittee meet jointly to review the United States response to the landmine threat in Bosnia. The decision to deploy United States forces to Bosnia as peacekeepers has raised serious questions concerning the threat of landmines to our soldiers, airmen, and marines who will be deployed to that region and who are deployed there now.

Various estimates have put the number of mines at Bosnia at over 2 million, many of them in unmarked minefields or scattered indiscriminately throughout the countryside. Landmines have already taken the lives and limbs of soldiers assigned to the United Nations Provisional Force [UNPROFOR] force in Bosnia and have caused their first casualties among United States and other North Atlantic Treaty Organization [NATO] forces deployed there.

Considering the landmine threat in Bosnia, concerns have been raised about United States force's ability to conduct countermine missions, particularly those involving area clearance, a capability that shares methods commonly used in humanitarian demining operations.

The widespread use of landmines by the belligerent forces in Bosnia, in marked and unmarked minefields and indiscriminate scattering of individual mines, poses a number of challenges in landmine detection and destruction. Although the military services

are developing several technologies that could provide an increased countermine capability, the state-of-the-art in countermine technology is still the hand-held mine detector and a soldier on his hands and knees using a fiberglass mine probe.

Today, the subcommittees will review the Department of Defense countermine and other demining and explosive ordnance disposal programs. We want to gain an understanding of the readiness of United States forces to deal with the landmine threat in Bosnia, what has been done to improve that capability, what technologies could be developed and procured which would improve the countermine capability of United States forces in Bosnia or in future Bosnia-like operations, and what barriers need to be overcome from the standpoints of technology, organization, and funding priorities to provide such capabilities.

I might add that this committee has been very supportive of funding requests above and beyond the requests made by the administration in this area. We will continue to be aggressive in our support financially of the need as determined by the military and by this committee.

Gentlemen, we look forward to your testimony today and to the dialogue that will follow. Before you begin, I would yield to Mr. Hunter. He is not here, so I will yield to Mr. Evans and any other Members who may want to make opening comments before we begin the formal proceedings.

[The statements of Congressman Weldon and Congressman Hunter follow:]

OPENING STATEMENT OF CURT WELDON
CHAIRMAN, RESEARCH AND DEVELOPMENT SUBCOMMITTEE
HOUSE NATIONAL SECURITY COMMITTEE

HEARING ON RESPONSE TO THE LANDMINE THREAT IN BOSNIA
JANUARY 24, 1996

TODAY, THE RESEARCH AND DEVELOPMENT SUBCOMMITTEE AND THE MILITARY PROCUREMENT SUBCOMMITTEE MEET JOINTLY TO REVIEW THE U.S. RESPONSE TO THE LANDMINE THREAT IN BOSNIA. THE DECISION TO DEPLOY U.S. FORCES TO BOSNIA AS PEACEKEEPERS HAS RAISED SERIOUS QUESTIONS CONCERNING THE THREAT OF LANDMINES TO OUR SOLDIERS, AIRMEN, AND MARINES, WHO WILL DEPLOY TO THAT REGION. VARIOUS ESTIMATES HAVE PUT THE NUMBER OF MINES IN BOSNIA AT OVER 2 MILLION, MANY OF THEM IN UNMARKED MINEFIELDS OR SCATTERED INDISCRIMINATELY THROUGHOUT THE COUNTRYSIDE. LANDMINES HAVE ALREADY TAKEN THE LIVES AND LIMBS OF SOLDIERS ASSIGNED TO THE UNPROFOR FORCE IN BOSNIA AND HAVE CAUSED THEIR FIRST CASUALTIES AMONG U.S. AND OTHER NATO FORCES DEPLOYED THERE.

CONSIDERING THE LANDMINE THREAT IN BOSNIA, CONCERNS HAVE BEEN RAISED ABOUT US FORCES ABILITY TO CONDUCT

COUNTERMINE MISSIONS, PARTICULARLY THOSE INVOLVING AREA CLEARANCE -- A CAPABILITY THAT SHARES METHODS COMMONLY USED IN HUMANITARIAN DEMINING OPERATIONS. THE WIDE SPREAD USE OF LANDMINES BY THE BELLIGERENT FORCES IN BOSNIA IN MARKED AND UNMARKED MINEFIELDS AND THE INDISCRIMINATE SCATTERING OF INDIVIDUAL MINES, POSES A NUMBER OF CHALLENGES IN LANDMINE DETECTION AND DESTRUCTION. ALTHOUGH THE MILITARY SERVICES ARE DEVELOPING SEVERAL TECHNOLOGIES THAT COULD PROVIDE AN INCREASED COUNTERMINE CAPABILITY, THE STATE OF THE ART IN COUNTERMINE TECHNOLOGY IS STILL THE HAND-HELD MINE DETECTOR AND A SOLDIER ON HIS HANDS AND KNEES USING A FIBERGLASS MINE PROBE.

TODAY, THE SUBCOMMITTES WILL REVIEW THE DEPARTMENT OF DEFENSE COUNTERMINE AND OTHER DEMINING AND EXPLOSIVE ORDNANCE DISPOSAL PROGRAMS. WE WANT TO GAIN AN UNDERSTANDING OF THE READINESS OF U.S. FORCES TO DEAL WITH THE LANDMINE THREAT IN BOSNIA, WHAT HAS BEEN DONE TO IMPROVE THAT CAPABILITY, WHAT TECHNOLOGIES COULD BE DEVELOPED AND PROCURED WHICH WOULD IMPROVE THE

COUNTERMINE CAPABILITY OF U.S. FORCES IN BOSNIA, OR IN FUTURE BOSNIA-LIKE OPERATIONS, AND WHAT BARRIERS NEED TO BE OVERCOME FROM THE STANDPOINTS OF TECHNOLOGY, ORGANIZATION, AND FUNDING PRIORITIES TO PROVIDE SUCH CAPABILITIES?

GENTLEMEN, WE LOOK FORWARD TO YOUR TESTIMONY TODAY AND TO THE DIALOGUE THAT WILL FOLLOW. BEFORE YOU BEGIN, I WOULD YIELD TO DUNCAN HUNTER, CHAIRMAN OF THE MILITARY PROCUREMENT SUBCOMMITTEE.

OPENING STATEMENT OF DUNCAN HUNTER
CHAIRMAN, MILITARY PROCURMENT SUBCOMMITTEE
HOUSE NATIONAL SECURITY COMMITTEE

HEARING ON RESPONSE TO THE LANDMINE THREAT IN BOSNIA
JANUARY 24, 1996

LANDMINES WILL LIKELY BECOME AN INCREASING THREAT TO OUR FORCES IN FUTURE MISSIONS. TODAY, EVERY WAR-FIGHTING COMMANDER-IN-CHIEF HAS A MAJOR UNCLEARED LANDMINE PROBLEM IN HIS AREA OF OPERATIONS. THE MILITARY SERVICES HAVE IDENTIFIED LANDMINES AS A SIGNIFICANT THREAT TO FUTURE FORCE PROJECTION OPERATIONS AND OPERATIONS OTHER THAN WAR. THE STATE DEPARTMENT HAS ESTIMATED THAT OVER 100 MILLION LANDMINES ARE SCATTERED AROUND THE GLOBE. WITH THIRD WORLD NATIONS AND REBEL GROUPS INCREASINGLY TURNING TO THESE CHEAP WEAPONS AS A FORCE MULTIPLIER, U.S. FORCES, IF DEPLOYED IN FUTURE CONFLICTS, PEACEKEEPING OPERATIONS, AND OPERATIONS OTHER THAN WAR WILL ENCOUNTER LANDMINES MORE FREQUENTLY.

AS MR. WELDON INDICATED IN HIS STATEMENT, THE ISSUES THAT WE WANT TO ADDRESS IN THIS HEARING ARE WHAT HAS

BEEN DONE TO IMPROVE THE CAPABILITY OF U.S. FORCES TO DEAL WITH THE LANDMINE THREAT IN BOSNIA; WHAT CAN BE DONE FROM THE STANDPOINT OF DOCTRINE, TRAINING, AND RESEARCH, DEVELOPMENT AND ACQUISITION TO FURTHER IMPROVE THE COUNTERMINE CAPABILITY OF U.S. FORCES IN BOSNIA, OR IN FUTURE BOSNIA-LIKE OPERATIONS; AND WHAT BARRIERS NEED TO BE OVERCOME TO MAKE THIS HAPPEN.

GENTLEMEN, I WELCOME YOU AND LOOK FORWARD TO YOUR TESTIMONY AND THE QUESTIONS AND ANSWERS WHICH WILL FOLLOW.

Mr. WELDON. Mr. Evans.

Mr. EVANS. Thank you, Mr. Chairman, and I want to thank you for calling this important hearing. I hope one of the things we can get out of this hearing is that the landmine situation in Bosnia is the exception, not the rule.

Because of the immensity of the problem, over 100 million anti-personnel mines scattered around the world, our forces must be prepared to face these weapons in the future. Because of this humanitarian crisis and the problems our own forces will face, I have advocated a total ban on the use and production of anti-personnel [AP] mines.

Congress is in the process of taking an important step in agreeing to a 1-year ban on these weapons. I hope that this move to show international leadership is the beginning of the end of the tens of thousands of innocent victims who are killed by these indiscriminate weapons annually. Yet no matter what happens on this question, we will all have to deal with the tens of millions of mines already scattered throughout the world.

Congress, through Congressman Dellums' leadership, took an important step in this direction by starting the fiscal year 1995 R&D program to look at new ways to detect and clear landmines. In conjunction with Department of Defense [DOD's] congressionally mandated humanitarian demining program, this program has been reaping real benefits in attacking the humanitarian problem, along with giving our forces new tools and expertise.

I hope that this hearing will bring into focus the advantage of these programs, along with what we need to do to help both our own soldiers and innocent women and children throughout the world cope with this problem. So, Mr. Chairman, I again salute you for holding the hearing.

Mr. WELDON. Thank you, Mr. Evans. I appreciate that statement.

Other opening statements by members?

With that, our witnesses today will be divided into two panels. The first panel will review the landmine threat in Bosnia and the United States policy for and capabilities of dealing with that specific threat. Panel two will discuss procurement, research and development, and technologies to meet future landmine threats.

We are very pleased to have our first distinguished panel at the table and would welcome you to begin your testimony. Captain Mazzafro, we will ask you to begin the proceeding.

STATEMENT OF CAPT. JOSEPH MAZZAFRO, USN, THE JOINT STAFF (J2)

Captain MAZZAFRO. Good afternoon. Thank you, Mr. Chairman. I am Joe Mazzafro with the Joint Chiefs of Staff, where I run the Yugoslavia Intelligence Task Force for the J–2 and provide the daily current intelligence updates——

Mr. WELDON. Excuse me. Could you pull the microphone closer to you?

Captain MAZZAFRO. Certainly, sir. Where I provide the daily current intelligence updates on crisis reporting that go to the Chairman of the Joint Chiefs of Staff and the Secretary of Defense. Obvi-

ously, the situation in Bosnia and the mine threat are daily issues for us.

What I hope to do today is to give you a brief unclassified intelligence assessment and overview of how we see the mine situation in Bosnia, to set the context for the other technology discussions that will follow after me.

Marcus [Captain Mazzafro addressed his assistant].

The way I propose to proceed is to discuss briefly the doctrinal use of mines in the Bosnian theater, the number and order of battle in broad scope. We will show you the minefields, what they look like, where they are laid. We will recount mine incidents that have occurred in general, and can go into detail, depending on your questions.

Since Interposition Force [IFOR] has deployed, we will then discuss the minefield status, cleared, marked, that sort of thing. I will also want to cover the other threats besides mines that IFOR is looking at over there, so you have a sense of context, and then wrap up with a bottom-line assessment of how we see the threat, the mine threat to the IFOR forces in Bosnia.

First, the doctrine, sir, of course, in the former Yugoslavia, the doctrine for mine utilization in Bosnia primarily comes from the Communist regime, the Warsaw Pact. That is usually a doctrine that employs mines as a defensive weapon and lays them in large blocks as a denial weapon, to restrict movement. That is the way we see mines being used in Bosnia, and we see them primarily placed for defensive purposes to keep people out of areas.

The order of battle that we assess in broad scope and round numbers—details, of course, are difficult when you begin to talk on this scale—but we assess that in Bosnia there are 2 million mines. Prior to the war, there were several factories that were capable of building indigenous mines in the theater and they were able to stockpile them.

The mines that we see and concern ourselves the most with are antitank and antipersonnel mines, and Mr. Reeder from the National Ground Intelligence Center in Charlottesville will be talking more specifically about those after I finish.

May I have the next slide, please?

I hope you can see that. We certainly have copies of it, sir. This is what we call a scattergram. It is a depiction of where the minefields are in broad scope. It is not a tactical plot. It is a strategic plot to show you the general areas where the minefields are generally laid in Bosnia, where the more or less 2 million are.

If you look at it in macro, what you will see is that the minefields primarily fall along the lines of confrontation of the warring parties prior to the Dayton agreement. Again, getting back to that doctrinal point that I was making, the mines were placed to keep people out of areas or to force people to move through certain checkpoint corridor kind of things.

The next map is actually a zoom-in or focus on the mines in the Tuzla area, and you can see to the west of Tuzla is a fairly extensive minefield. The reason for that minefield, just as an anecdote, was that it was mined by the Muslims to prevent the Serbs from widening the Posavina Corridor, in other words, connecting the

country between the former Yugoslavia and western Bosnia, Ostra Luka, was one of the Serb centers of gravity.

Next slide, Marcus.

This graphic, sir, depicts the 11 mine incidents that we have had to date in Bosnia since IFOR deployed in December. There have been 12 wounded. There have been none killed to date. As you can see, the nationalities are across the board for those forces in IFOR, and the locations—there is no rhyme or reason or pattern to the location. They are not centralized in one particular place. They are scattered. They are random events, as you would expect from the way the mines have been laid.

Moving over to the other board, sir, what we know about the minefields, given that 2 million, and getting a little more detailed. We believe, based on reporting from our engineers, Army engineers that are over in-country and the information that they are getting, that they are supposed to get from the warring factions, that there are 6,200 minefields in Bosnia, approximately 2,000 in the American sector up and around Tuzla. Approximately 30 percent of those 6,200 minefields have been reported cleared.

What that means, sir, is that one of the factions; the Bosnian Serbs, the Bosnian Croats, or the Muslim government forces have reported this is a minefield. It is cleared, or in the second category, 25 percent have been marked, leaving, of course, 45 percent that are unmarked.

Now, the next event that has to happen, of course, to operate safely, is once you get this information you then need to go out and verify it. That verification is just now beginning, where American and IFOR engineers and intelligence analysts are verifying the reports that we have gotten from the parties. Which they were supposed to do.

Let me have the next slide, Marcus.

As you know, the mines were supposed to be marked and cleared completely, and the areas to be essentially safe for IFOR operations by the 19th of January, 30 days after the signing. This is a technical issue of noncompliance with Dayton. It is really not a violation in the spirit.

The scope of the problem, the number of mines and the weather have really prevented the full marking and clearing of the mines as we would have expected by January 19. There has been broad cooperation by all three parties to identify the mines and report them to us and assist IFOR with understanding and knowing where the fields are.

I would hasten to add, while there is broad cooperation, cooperation doesn't overcome the problem that in many cases the minefields were poorly marked when they were laid. The records were not kept or the records are incomplete. So with the information that they have, they are being as cooperative as possible, but it is important to understand that that information is flawed and fragmentary in many cases.

As I said at the outset, landmines are only one of the threats to the U.S. forces, that the U.S. forces face in IFOR. In fact, if you were to ask me, and based on what we have been telling the Chairman and the Secretary of Defense, the most recurring action has

been disgruntled soldiers aiming weapons at IFOR personnel and having those weapons knocked away. They haven't been fired.

But these are not acts of policy. They are acts of individuals. Undisciplined local factions and individuals are the threat down there, people that are just upset with the situation and the way it is going, and having a weapon in their hand and being able to potentially use it or point it at someone. That seems to be the most prevalent recurring threat that we certainly have been seeing in the past couple of weeks.

As I said, we have had the 12 landmine incidents. We, of course, continue to have worries about the foreign elements in there and the Iranian connection, potential mujaheddin terrorists. But landmines, what I want to stress here, are not the only threat that our forces face. They are one, and have to be seen in the context of threat, and in fact in many days they are not the primary threat the forces face.

What I would like to conclude with, and what I hope I have given you a sense of from what I have been able to share with you today at this level, is that we believe we have reliable intelligence on the mine situation. We believe we have that from previous intelligence estimates, from having tracked the former Yugoslavia. We believe that information is being adequately and significantly supplemented by what the warring factions are providing to us in accordance with the Dayton accords.

And, as I think you are going to hear and be convinced in a few moments, we have a wonderful scientific and technology data base from which to assess what these mines are, how they operate, how they should be cleared, how they should be searched for and how they can be handled in a safe way in a battlefield environment.

As I said, we have the cooperation of the warring factions, and from our perspective that makes the mine threat certainly dangerous but a manageable threat to the implementation force in Bosnia, sir. Pending your questions.

Mr. WELDON. Thank you, Mr. Mazzafro. We will hold the questions until we have the whole panel.

With that, we will turn to Mr. Reeder, who is an intelligence analyst for the National Ground Intelligence Center. Thank you, and you may begin.

STATEMENT OF THOMAS REEDER, LANDMINE WARFARE ANALYST, NATIONAL GROUND INTELLIGENCE CENTER

Mr. REEDER. Mr. Chairman and members of the committee, thank you for the opportunity to appear today before you regarding the landmine threat in Bosnia and Herzegovina. It is a privilege for me to be able to present technical aspects of the landmine threat and perhaps to provide a perspective on these issues. I am Tom Reeder. I am from the National Ground Intelligence Center. I am a mine warfare analyst and have been studying foreign landmine use and landmine operations for the last 14 years.

The landmine threat in the region of the former Republic of Yugoslavia is pervasive. For 4½ years mine laying has been ongoing, encompassing every imaginable method ranging from well planned and in place, marked and monitored minefields, to simple hand-scattered antipersonnel mines. Additionally, sophisticated

mine laying techniques have been developed which have enhanced obstacles while protecting the mines themselves.

A serious threat from booby traps also exists. From the onset, the former Yugoslavian army was extremely well equipped with mines, fuses, special booby trap devices and explosives. The breakdown of national authority, open displays of ethnic hatred, time and these devices themselves have fostered a willingness to booby trap mines, equipment, facilities, and buildings.

Quite simply, the landmine situation faced is among the worst in the world. To put it in perspective, only Afghanistan, Cambodia, and Angola clearly have a more daunting problem. Bosnia alone certainly faces at least 1.7 million mines; in the region, 5 to 7 million. As national demining centers emerge, these numbers will fluctuate, but they will not change the obvious scope of the problem.

A few germane points to consider: It has been brought up by a number of parties that the former Yugoslavia was a major producer of mines and, again, the vast majority of mines that are being found were produced by the former Yugoslavia. Many of the antipersonnel and antitank mines that are being used are within the category of what we would describe as low metallic content, difficult to detect mines, and I have some examples of these that we can discuss.

Perhaps more than 10,000 minefields exist within the region. But, again, most minefields are small point minefields, and they are located at what were once considered important checkpoints, strategic locations, et cetera. But you have to bear in mind the passage of time and the movement of combatants. Shoulders, bypass routes, and U.N.-approved roads, most major routes are safe but shoulders, bypass routes and unapproved roads are highly suspect.

We also have to keep in mind that there are some unique regional flavors to this mine laying in Yugoslavia. For example, lessons you may have learned in one location may not directly translate to another location. It is very complex, and those mines and booby traps present a continuous problem to the civilians. The watchword in describing the mines there is that they are random and poorly marked.

Again on an up-note, before I finish this train of thought, we do have to bear in mind that UNPROFOR forces were able to successfully operate in this region under these circumstances.

I would like to close my prepared comments today with an observation based on participation and support provided to a number of peacekeeping operations or major deployments of the United States and allied forces over the last two decades. I am going to try to do this in a time-line manner so you can understand how this flowed.

The landmine situation in Bosnia began to develop as early as mid-1991. In 1992 and 1993, studies in handbooks which quantified this threat were published by the intelligence community jointly with the United States Army Engineer School and our allies.

The result is that U.S. Army and allied engineer units throughout Europe quickly and early became focused upon this threat, and they began requesting technical data from their own schools as well as the Euro-NATO Training Engineer Center in Munich. As allied engineer units participating in UNPROFOR developed exper-

tise in these engineer operations, their observations and lessons learned were freely shared.

I feel that this early awareness by engineer commanders and engineer staff officers, in conjunction with the obvious world focus, translated to some serious planning by our military leadership.

The end result of this planning and preparation is that prior to movement of a single IFOR unit, I think the theater was firmly in control. They have established means to analyze and plot known mine locations and to ferret out additional data. This theater response and level of expertise far exceeds anything that I have ever seen, and they have my full respect and admiration.

Thank you.

[The prepared statement of Mr. Reeder follows:]

23 JANUARY 1996

LANDMINE THREAT IN THE FORMER REPUBLIC OF YUGOSLAVIA

MR. THOMAS S. REEDER

LANDMINE WARFARE ANALYST

NATIONAL GROUND INTELLIGENCE CENTER

LANDMINE WARFARE - WORLDWIDE

Mr. THOMAS S. REEDER - BIO SKETCH

Mr. Reeder is assigned as the senior landmine warfare subject-area analyst, responsible for all-source analysis and intelligence production. Mr. Reeder functions as the focal point for a complex subject area regularly representing Department of Defense and national intelligence agencies. Threat briefings and assessment products are frequently provided in support of multi-service materiel development efforts as well as international programs. Mr. Reeder and his staff have successfully accomplished landmine survey and assessments throughout the world (Afghanistan, Cambodia, El Salvador, Egypt, Eritrea, Ethiopia, Kuwait, Malawi, Mozambique, Namibia, Nicaragua, and Somalia) in support of potential and ongoing international demining programs. As a result of Mr. Reeder's accomplishments, the National Ground Intelligence Center has been identified as the "Center of Excellence for Foreign Landmine Warfare." The special surveys and assessments ensued from taskings which supported various agencies including the United Nations (High Commissioner for Refugees), the International Commission of the Red Cross, the Department of State (Office of Foreign Disaster Assistance, Refugee Affairs, and Political Military - International Security Operations), the Organization of American States, and the Department of Defense.

Mr. Reeder has been a landmine warfare analyst at the National Ground Intelligence Center for the last 13 years. Prior to this period, he served 4 years in the US Army and 4 years in industry. As a Senior Staff Engineer, Mr. Reeder was responsible for estimates, budget, design, contracting, scheduling, and supervision of construction efforts for all major facilities of a major oil company. As a combat engineer officer, Mr. Reeder served in the 82d Airborne Division both in the 307th Engineer Battalion (ABN) and the 618th Engineer Company (LE) (ABN).

Mr. Reeder holds a Bachelor of Science in Civil Engineering from the Virginia Military Institute where he graduated with distinction. His civilian accomplishments include awards for service in Desert Shield/Storm, the Defense Intelligence Agency Director's Award for Intelligence, and the Director of Central Intelligence's National Intelligence Medal of Achievement. Key military accomplishments include Honor Graduate of the US Army Ranger School, completion of both Airborne and Jumpmaster Schools, and the award of the Master Parachutist badge. Mr. Reeder's personal interests include commercial wine grape production, horseback riding, boating (canoe and kayak), hiking, farming, and enology.

BOSNIA AND LANDMINES

INTRODUCTION

1. Landmines have been used extensively by all of the warring factions in the former Republic of Yugoslavia (FRY). Mines have been acknowledged by in-country peacekeeping forces as the greatest single threat to UN personnel. Historically, the use of mines and boobytraps in a conflict of extended duration has implications long after the conflict ends, especially impacting the civilian population.

2. The Yugoslav National Army (JNA) used landmines in a fairly disciplined and controlled manner whereas the other factions have been much less disciplined in their mining practices. Landmines have been used for point, area denial (e.g. airports), nuisance, and random mining. As an example, in the Vukovar, Croatia area alone, the JNA claimed that over 100,000 antipersonnel mines were emplaced by the summer of 1992.

3. The threat presented by landmines employed in the FRY has been described in a number of publications intended to provide detailed information to senior leaders, planners, warfighters, and developers of doctrine and equipment. The primary source documents are:

> Former Yugoslav Air and Ground Systems Report: Combat Engineer and Logistics (U), DST-1100R-219-92-RPT 6, September 1992, SECRET-WNINTEL
>
> Former Yugoslav Air and Ground Systems Report (U), Supplement 1, DST-1100R-219-93, May 1993, SECRET
>
> ENGINEER CONTINGENCY HANDBOOK (Former Yugoslavia, July 1993, UNCLASSIFIED

The last source document resulted from a collaborative effort led by the US Army Engineer School with input from the National Ground Intelligence Center, Canada, France, Germany, and the United Kingdom. Technical data on these landmines has also been made available on a number of CD-ROM products.

4. The current best technical assessment of the total number of landmines in the region follows:

Bosnia	-	1.7 million mines
Crotia	-	2.0 million mines
Serbia	-	.5 to 1.0 million mines
Totals for FRY	-	5.0 to 7.0 million mines

Note: Numbers ranging from 3.0 to 6.0 million for Bosnia/Herzegovina are assessed to be inflated numbers.

LANDMINE USE

1. With the visualization of a threatened breakup of the Former Republic of Yugoslavia, the Yugoslav government began planning to protect key facilities in the event any transition became violent. One facet of this plan involved the mining of airfields and other government facilities. During the summer of 1991 the Yugoslav National Army began to implement this plan. Ultimately, at least 70 airfields alone were mined with between 3,000 and 10,000 mines each. The airfields at Sarejevo and Tuzla are examples of minelaying that occured during this period. These minelaying activities were accomplished in a disciplined and controlled manner resulting in patterned, recorded minefields and with extensive demolition emplacements intended to destroy these same facilities when overrun.

2. As control within the FRY became localized and disjointed, the goals behind minelaying activies changed. The individual factions first began to use landmines as a means of controlling access to their respective territory. This is the period in which mines (primarily antitank) became common at bridges, roadblocks, checkpoints, and control points. Initially these mines were only surface-placed and often removed each morning to be re-laid at dusk. Soon traditional antipersonnel (and occasionally antitank) mines and minefields began to be laid extending outward from these small point minefields. These mines were often laid without standard pattern, recording, or marking/fencing.

3. Territorial limits that were initially tentatively established began to change hands. This period in the break-up of the former Republic of Yugoslavia is marked by the use of mines and minefields in a far less controlled manner. Mines began to be used within formerly controlled areas such as villages and commercial and government facilities. Additionally, the use of boobytraps began to escalate as well as become more sophisticated.

4. Landmines continued to play an important role in the fighting in the former Yugoslavia. Mines were used by all factions to protect military installations and ethnic enclaves from attack. Mines have also been used extensively to block roads leading to these enclaves. These mines served a dual purpose: supplies and reinforcements could not reach the besieged city and refugees were less likely to flee prior to signing of a truce and guarantee of safe passage.

LANDMINES EMPLOYED IN THE FORMER REPUBLIC OF YUGOSLAVIA

1. Conventional Mines. The vast majority of the landmines being encountered are conventional antipersonnel and antitank mines which were produced in the former Yugoslavia. A detailed listing of the mines being encountered is attached. Among the antipersonnel mines, those mines most commonly encountered are the **PMA-1A**, the **PMA-2**, the **PMA-3**, the **PMR-2A**, and the **PROM-1**. Approximately 75 percent of all buried antipersonnel mines are low-metallic-content, difficult-to-detect landmines. The most common antitank mines are the **TMM-1**, the **TMA-3**, the **TMA-4**, and the **TMRP-6**.

2. Improvised Fragmentation Mines. Fragmentation mines are currently being produced locally in many areas of Bosnia. These mines can be fabricated out of materials which are readily available, such as pipes and tubing. One typical mine is constructed from a short piece of heavy gauge steel pipe threaded and plugged at both ends. The body is scored to aid fragmentation. The mounting stake connects into the bottom of the mine. A hole is drilled into the top plug so a standard fuze can be used. Mines made of other pipe types with different scoring patterns have also been recovered in other areas of the country.

3. Boobytraps. Any of the former Yugoslav mines can be booby-trapped, and some, like the **TMRP-6** antitank mine have secondary fuze wells specifically for this purpose. Additionally, the **TMRP-6** fuze, the **UTMRP-6**, can initiate during removal from the antitank mine. The black powder clearing charge can initiate even when the fuze is in a "safe" condition. **DO NOT ATTEMPT TO REMOVE THIS FUZE FROM THE MINE.**

4. Special Fuzes. A **USE-T** Superquick time delay fuze has been recovered within a UNPROFOR sector. The **USE-T** fuze can be set to detonate from 6 to 9999 minutes. Other fuzes in the series function on vibration, acoustic, inertia, light, thermal, and trip wire (for additional information refer to DST-1100R-219-92-RPT 6, SEP 93, pages 2-15 and IV-71 to IV-73). It is not known if other fuzes from the series have been employed, or if use of the time delay model is wide spread since recovery is impossible when the devices function properly. Compatible for use in both landmines and demolition charges, these fuze assemblies pose special difficulties in clearing/breaching operations since they often mask antihandling/antidisturbance features.

THE DAYTON AGREEMENT

1. During each of the ceasefire agreements, all warring factions have discussed the need to locate, identify and clear mines. This reflects the extent of the mine problem, which would face any force entering the region and suggests that difficulties will continue during reconstruction after hostilities cease.

2. The negotiations which led to the Dayton Agreement had to deal with many issues including landmines. Two annexes within this agreement address these issues. Annex 1-A (Agreement on the Military Aspects of the Peace Settlement) and Annex 1-B (Agreement on Regional Stabilization) have the following provisions:

Immediately:

- o Stop placing any minefields, barriers, obstacles

- o Following establishment of the Joint Military Commission each Party shall furnish information regarding all known explosive devices, demolitions, minefields, boobytraps and all other hazards to the safe movement of any personnel within Bosnia and Herzegovina

Within 30 days:

- o Remove, dismantle, or destroy all mines, explosive devices, demolitions from the Agreed Cease-Fire Zone of Separation from which their forces are withdrawn

- o Mark all known mine emplacements, explosive devices and demolitions within Bosnia and Herzegovina

- o Remove, dismantle, or destroy all mines, explosives devices, or demolitions as required by the IFOR Commander

Within 45 days (Phase II):

- o The withdrawing Entity will remove or dismantle all mines, obstacles, explosive devices, and demolitions from areas which will be transferred to another Entity

Within 120 days (Phase III):

- o Forces to be demobilized will have all their explosive devices (and other military equipment) removed prior to their release from service

3. The Parties of the Dayton Agreement have committed themselves to accomplishing certain mine warfare tasks critical to the continued success of the cease-fire. It is also necessary to complete these tasks in good faith in order to alleviate the burden on the civil population as they attempt a return to normalcy. Additionally, fulfilling these requirements will greatly reduce the risk of U.S. lives being lost to landmine incidents.

LANDMINES AND DEVICES CURRENTLY IN USE *

ANTIPERSONNEL AND SIGNAL MINES

	PMD-1	wooden, blast (similar to PMD-6M) ***
	PMA-1	wooden, blast (similar to PMD-6M) ***
**	**PMA-1A**	plastic, blast (similar to PMD-6M) ***
	PP-56	plastic, blast
**	**PMA-2**	plastic, blast ***
**	**PMA-3**	plastic, blast ***
	TM-100	100-gram explosive block, blast, variety of fuzes
	TM-200	200-gram explosive block, blast, variety of fuzes
	TM-500	500-gram explosive block, blast, variety of fuzes
	MT-4	4,000-gram explosive block, blast, variety of fuzes
**	**PMR-2, -2A, -2AS**	stake mine, fragmentation
	PMR-3	stake mine, fragmentation
	PMRS-1, -2	stake mine, illumination
**	**PROM-1**	bounding mine, fragmentation
	PROM-2	bounding mine, fragmentation
	PROM-KD	bounding mine, fragmentation
	PSM-1	bounding mine, fragmentation (Bulgarian)
	MRUD	directional mine, fragmentation

ANTITANK MINES

	PT-56	plastic, blast
	MAT-76	caseless, blast, pressure-fuzed (Romanian)
	TM-62	series plastic, caseless, or metal, pressure-fuzed (origin unknown i.e. Former Soviet, Bulgarian, Polish, Former East German, etc)
	TMD-1, -2, -2D	wooden, blast, pressure-fuzed
**	**TMM-1**	metal, blast, pressure-fuzed
	TMA-1, -1A	plastic, blast, pressure-fuzed ***
	TMA-2, -2A	plastic, blast, pressure-fuzed ***
**	**TMA-3**	plastic, blast, pressure-fuzed ***
**	**TMA-4**	plastic, blast, pressure-fuzed ***
	TMA-5, -5A	plastic, blast, pressure-fuzed ***
**	**TMRP-6**	plastic, plate-charge, tiltrod or pressure-fuzed
	MC-71	metallic, shaped-charge, tiltrod-fuzed (Romanian)
	U/I SM	metallic, shaped-charge, magnetic-fuzed (delivered by M-87 MRL) (never employed by any force)
	U/I Mine	metallic, blast, light AT mine, pressure-fuzed (similar to WWII German L.Pz.Mi or Dutch Type II)

* Unless indicated otherwise, all mines are of former Yugoslav manufacturer

** For export purposes, the PMA-series and TMA-series mines are sometimes described and marked as PAM-series and TAM-series.

*** Approximately 75% of all buried antipersonnel mines are low-metallic-content, difficult-to-detect landmines

TRAINING MINES

VPMA-1A, VPMA-2, VPMA-3
VPMR-2A, VPMR-2AS, VPMR-3
VPROM-1
VTMM-1, VTMA-1A, VTMA-2A, VTMA-3, VTMA-4, VTMA-5

FUZES AND ANTIHANDLING DEVICES

EMU-1 electromechanical fuze, pressure, pressure-release, pull
USA-T boobytrap/antihandling device, "SUPERQUICK", acoustic
USE-T boobytrap/antihandling device, "SUPERQUICK", electronic, time
USI-T boobytrap/antihandling device, "SUPERQUICK", inertia
USS-T boobytrap/antihandling device, "SUPERQUICK", light
UST-T boobytrap/antihandling device, "SUPERQUICK", thermal
USV-T boobytrap/antihandling device, "SUPERQUICK", vibrating
UEP-z boobytrap/antihandling device, "SUPERQUICK", electronic trip
UDZ-1 mechanical fuze, trip (axial pull)
UMP-1 mechanical fuze, trip (axial pull)
UDOP-1 mechanical fuze, pressure release or trip (pull)
UMP-2, 2V mechanical fuze, trip (pull 90° to fuze body)
UMOP-1, 1V mechanical fuze, pressure release
UMNOP-1, 1V mechanical fuze, multipurpose, trip release or pressure
UMNP-1, 1V mechanical fuze, multipurpose, pressure or trip

DEMOLITION EQUIPMENT

MP-EDK-M blasting machine
M-LUD-MP 1500 remote mine detonator, laser type
SD-2 detonating fuze
UNIKORD safety (time) fuze
No. 8 non-electric detonator
EK-40-69 electric detonator
SU-10 M66/1 time-delay clockwork fuze
SU-24 M70 time-delay clockwork fuze
UDVK chemical delay fuze

VERY SHALLOW WATER, RIVERINE, AND LIMPET MINES

PLRM-1 river, drifting
M71 anti-diversionary mine, antiremoval and time delay detonation
M81 anti-diversionary mine
MPP limpet mine
MPR-M85 limpet mine
TAN-76 limpet mine

UNPROFOR MINE-RELATED INJURY DATA

UNPROFOR MINE-RELATED INJURIES (AS OF APRIL 1993)

	CROATIA	BOSNIA	OTHER	TOTAL
FATAL	5	1	0	6
NON-FATAL	41	18	2	61
TOTAL	46	19	2	67
PERCENT OF TOTAL CASUALTIES	56	14	29	30

UNPROFOR MINE-RELATED INJURIES (AS OF JUNE 1995)

204 CASUALTIES AND 20 DEATHS IN 174 INCIDENTS			
	FRANCE	UNITED KINGDOM	CANADA
PERCENT OF MINE INJURIES FOR UNPROFOR	36	29	28

THE NUMBERS OF CASUALTIES/DEATHS THROUGH JUNE 1995 (204/20) EQUATE TO ABOUT 13% OF OVERALL UN LOSSES IN THE REGION. ON THE SURFACE, THIS IS CLEARLY A DROP FROM THE PREVIOUS REPORTING PERIOD (APRIL 1993) WHEN ABOUT 30% OF INJURIES WERE MINE RELATED. HOWEVER, IT IS CLEAR THAT THE OVERALL NUMBER OF MINE INCIDENTS AND INJURIES ARE CLEARLY INCREASING. THE INCREASING MINE INJURIES OCCURRED WHILE NON-MINE INJURIES INCREASED AT A MUCH HIGHER RATE. THIS REFLECTS THE INCREASING RISK IN THE REGION FOR OPERATING FORCES.

SELECTED LANDMINE WARFARE PRODUCTION BY THE NATIONAL GROUND INTELLIGENCE CENTER

STUDIES

Landmine Warfare - Trends and Projections

Landmine Warfare - Mines and Engineer Munitions in Angola

Landmine Warfare - Mines and Engineer Munitions in Central America

Landmine Warfare - Mines and Engineer Munitions in Eritrea

Landmine Warfare - Mines and Engineer Munitions in Mozambique

Landmine Warfare - Mines and Engineer Munitions in Somalia

Landmine Warfare - Mines and Engineer Muntions in Southern Africa

Landmine Assessment Survey - Central America

Landmine Assessment Survey - El Salvador

Landmine Assessment Survey - Mozambique/Malawi

Eritrea / Ethiopia Handbook

Former Yugoslav Weapons Handbook

Mine Warfare and Recognition Handbook - Desert Shield

Somalia Weapons Handbook

Former Yugoslav Air and Ground Systems Report: Combat Engineer and Logistics and Supplement 1)

Mine / Countermine Warfare - The Threat

Combat Engineer Capabilities - China

Combat Engineer Capabilites - Iraq

Combat Engineer Capabilities - USSR

Developments in Soviet Scatterable Mines

Soldier Capabilities and Equipment: Vol I - Peacekeepers and Peacekeeping Equipment

CD-ROM PRODUCTS

Landmines and Demining - Global Problem

MineFacts

Mines of the World

RECAP OF LANDMINE SITUATION - BOSNIA

FORMER REPUBLIC OF YUGOSLAV (FRY) WAS A MAJOR PRODUCER OF LANDMINES

MINELAYING BEGAN BY JNA IN JULY OF 1991

VAST MAJORITY OF MINES ENCOUNTERED WERE MANUFACTURED IN THE FRY

MINES USED EXTENSIVELY BY ALL FACTIONS

OFTEN SEEN AS THE NUMBER 1 THREAT TO UN FORCES

THOUSANDS OF MINEFIELDS THROUGHOUT THE REGION

MOST MINEFIELDS ARE SMALL, POINT MINEFIELDS AT CRITICAL CHECKPOINTS, STRATEGIC LOCATIONS, ETC

TRAVEL ON MOST MAIN ROUTES SAFE

SHOULDERS, BY-PASS SITES, UNAPPROVED ROADS HIGHLY SUSPECT

BOTTOM LINE

UNPROFOR OPERATED SUCCESSFULLY IN REGION

MAJOR ROUTES CLEAR OF MINES

NO UN-COORDINATED OFF-ROUTE MOVEMENT SHOULD OCCUR

ESTABLISHING QUARTERING SITES DANGEROUS, TIME-CONSUMING MISSION

UNIQUE REGIONAL FLAVOR IN MINELAYING ACTIVITIES

LANDMINES VISUALIZED AS NUMBER 1 THREAT TO UN FORCES

TERRAIN LIMITS EFFECTIVENESS OF STRATEGIC SENSORS TO FIND MINES

MINES AND BOOBYTRAPS CONTINUOUS PROBLEM TO CIVILIANS

RANDOM AND POORLY MARKED - DESCRIBES MINEFIELDS IN REGION

Mr. WELDON. Thank you, Mr. Reeder.
General Gill.

STATEMENT OF MAJ. GEN. CLAIR F. GILL, COMMANDING GENERAL, U.S. ARMY ENGINEER CENTER/SCHOOL, U.S. ARMY

General GILL. Good afternoon, Mr. Chairman, committee members. It is a pleasure to appear before these subcommittees in joint hearings today. I am Maj. Gen. Clair Gill, Commandant of the U.S. Army Engineer School at Fort Leonard Wood in south central Missouri.

Engineer soldiers have a long history of service to our Nation in many diverse fields: as combat engineers within the maneuver task force, as construction engineers building the enabling infrastructure for both combat and for peace operations, and as the custodians of much of our Nation's natural treasures.

Today, I wish to focus on one aspect of the military engineer: countermine operations. We have this responsibility as part of the mobility battlefield operating system. Battlefield operating system is the U.S. Army Training and Doctrine Command's taxonomy for assigning attendant duties. My immediate superior is Gen. William Hartzog, the commander of Training and Doctrine Command at Fort Monroe, VA. The business of the Training and Doctrine Command is to prepare the future Army to execute the national military strategy. I would like to make the point that while I do not command operational forces, my responsibility extends to continual oversight and assistance to the Army in the field concerning engineer operations.

Some components of what we title countermine operations are within the purview of other Army branch school commandants, for example, the commandant of armor school has responsibilty for the tank-mounted rollers and plows. The infantry school commandant is responsible for some individual countermine measures such as hand-held explosive minefield breachers. However, most of the Army's countermine solutions are my responsibility.

Today's testimony will consist of two parts: a threat and operations panel and a technology panel. Some testimony will overlap, but it is not only because the panel members prepared for these hearings independently. Please consider that the overlap represents different perspectives of the same issues.

I believe it is important to establish three key definitions of terms early in the hearing. These terms are countermining, mine clearance, and demining.

Countermining are the tactics and techniques used to detect, avoid, breach and/or neutralize enemy mines. Mine clearance is the removal of mines within the minimum area required for friendly military operations. Demining is not a term in our military dictionary. I have borrowed the definition from "Hidden Killers," the State Department's seminal document on worldwide antipersonnel mine problems. Demining is a new term related to but out of the realm of conventional countermine. It refers to the complete removal of all landmines from an area in order to safeguard civilian populations.

Also, as a frame of reference we will occasionally speak of unexploded ordnance, or UXO. We are using a narrow application

and generally refer to battlefield unexploded ordnance. Today most modern artillery rounds and air-delivered bombs are carriers for submunitions, small explosive devices usually called cluster munitions, that enhance the effectiveness of area weapons. Coalition forces used large numbers of cluster munitions in the gulf war.

In Bosnia, we expect to find mostly older unitary or single-cased, high explosives-filled artillery and mortar shells. When we encounter unexploded ordnance, the effect is similar to mines and minefields. Therefore, while we have two different problems, there are similar sets of solutions. The high threat situation in Bosnia is mines, although we are alert for various types of unexploded ordnance.

Developing soldier awareness is key. I cannot over-emphasize the importance of a mine aware soldier. All soldiers, not just engineers, receive unexploded ordnance [UXO] identification and hazard training during their initial entry training. The primary lesson objectives are to identify, avoid and report.

For engineers, this training is further reinforced during advanced individual training to include additional UXO and mine identification, marking, detection and removal. Our engineer leaders are also trained as sergeants and lieutenants in these same tasks, as well as the mechanics of training, planning, and leading countermine operations.

Our collective mission training plans cover detailed tasks, conditions and standards for countermine operations, and these tasks are backed up with our doctrinal how-to literature. After initial training, soldiers are trained in their unit on particular unit responses to mines and minefields. This phase of developing mine awareness is a unit responsibility.

Army units filter the plethora of training tasks through their mission essential task list or METL. The METL is designed to simplify and focus the training requirements for units based on the tasks they think they will most likely have to execute during wartime. Engineers typically focus on mine removal and breach training because these are some of their most likely and hazardous wartime tasks.

Finally, prior to any actual deployment, we conduct mission training on the particular mine threat and effective countermine responses within that area of operations. The engineers have also trained soldiers of other branches of the Army, as well as Air Force and Navy personnel, in mine awareness.

Examples of this are the ongoing training taking place in Germany for all soldiers deploying to Bosnia, and the training teams the United States Army Engineer School has sent to both European and continental United States units to assist them in their predeployment training. Every soldier, sailor, airman, marine, and civilian deploying to Bosnia receives mine awareness training.

The U.S. Army Engineer School, with borrowed experts from Program Manager Mines, Countermines and Demolitions, Night Vision Engineering Lab and the Joint Project Office, Unmanned Ground Vehicles, formed a mobile training team that deployed to Germany to train the 16th, 23d, and 40th Engineer Battalions on the use of three developmental remote-controlled countermine systems—Badger, Panther, and a miniflail.

The mobile training team also assisted in the installation and use of antiblast or fragmentation protection blankets, body armor individual countermine and bolt-on protective kits for HMMWV and 5-ton vehicles. Additionally, the team demonstrated developmental countermine equipment such as the thermal line avoidance system, Barrett Rifles with explosive rounds, and the Field Expedient Countermine System.

There is no silver bullet to the complex mine threat. We train our soldiers and their leaders, write and apply effective doctrine, develop responsive organizations, and field a suite of high-, medium- and low-tech equipment. The thermal mine avoidance system is an example of high technology, the Barrett Rifle of medium technology, and a simple mine probe like one of these, low technology. Each has its place and all of these efforts assist and enhance field countermine operations. Our efforts are focused on developing a mine-aware and mine-alert soldier.

The mine threat is of great concern to us. We cannot guard every footfall, cannot prevent all innocent errors such as taking a wrong road, in spite of our care. We do the best job we possibly can to prepare and equip our soldiers.

Collectively, we know a great deal about the mine threat and about countermining. At the same time, we are continually looking for more good ideas, anything we can obtain from any source to evaluate and possibly apply to the countermine problem.

But not all ideas are good ones. We must not overwhelm the IFOR commander with dozens of raw ideas and requirements that place soldiers at greater risk. At the same time, we don't want to miss anything of value. I am confident that we have done and are doing all that we can do to protect our soldiers. Thank you very much.

Mr. WELDON. Thank you, General Gill.

[The prepared statement of General Gill follows:]

STATEMENT BY

MAJOR GENERAL CLAIR F. GILL

COMMANDER, US ARMY ENGINEER SCHOOL

UNITED STATES ARMY

BEFORE THE

JOINT SUBCOMMITTEES OF MILITARY PROCUREMENT AND

MILITARY RESEARCH AND DEVELOPMENT

COMMITTEE ON NATIONAL SECURITY

UNITED STATES HOUSE OF REPRESENTATIVES

SECOND SESSION, 104TH CONGRESS

RESEARCH AND DEVELOPMENT RESPONSE TO COUNTERMINE THREAT IN BOSNIA

JANUARY 24, 1996

NOT FOR PUBLICATION
UNTIL RELEASED BY THE
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Good afternoon. It is a pleasure to appear before these subcommittees in joint hearings today. I am Major General Clair Gill, Commandant of the US Army Engineer School at Fort Leonard Wood in south-central Missouri. Engineer soldiers have a long history of service to our nation in many diverse fields-- as combat engineers within the maneuver task force, as construction engineers building the enabling infrastructure for both combat and for peace operations, and as the custodians of much of our nation's natural treasures. Today, I wish to focus on one aspect of the military engineer, countermine operations. We have this responsibility as part of the "Mobility" battlefield operating system. Battlefield operating systems is the US Army Training and Doctrine Command's taxonomy for assigning attendant duties. While some of the components of what we title, "countermine operations" are within the purview of other Army branch school commandants, most of the parts are mine.

The US policy for dealing with the threat and for countermine operations by US Forces in Bosnia is that we will conduct only those countermine operations required to protect the US and NATO forces.

In Bosnia, we will protect the force on a continual basis and regard the countermine challenge in terms of "force protection," rather than the normative "mobility" battlefield operating system. By US Army doctrine (and NATO doctrine, which

is identical), the Army conducts minefield breaching operations to clear a safe path through a minefield for the use of troops and vehicles. Normally breaching is done under the threat of direct enemy intervention and fire. The Army also conducts "clearing," which is the removal of mines within the minimum area required for immediate military operations, an example of which would be to clear the area required for a forward supply point or a route such as Route Arizona in Bosnia. Also, if the US Army employs minefields, we are responsible for removing them. The Army does not conduct "demining," which is defined as the complete removal of all landmines and unexploded ordnance from an area in order to safeguard civilian populations. Demining is an extremely soldier and time extensive operation and is normally contracted. Therefore, in Bosnia, we will conduct countermine operations in such places as bivouac and administrative areas, patrol routes, and required highways and their shoulders. Any minefields that we discover, but have no need to remove are marked and reported. We will also be prepared to conduct combat countermine operations should we have to conduct operations incidental to violations of the accord.

US Forces will not normally remove minefields and landmines employed by the former belligerent forces and will not directly conduct "humanitarian demining" operations.

Mines that are left over from the years of fighting are the responsibility of the former belligerents. Annex 1 Article IV of the Dayton Agreement pledges the parties to "remove, dismantle or destroy all mines . . ." Their problem is extremely large. When we find mines or minefields they will be marked and reported to the same standards we use for our own minefields and the information will be provided to the host nation for their use. These minefields will only be cleared based on military necessity to support the operation.

US Forces have a complete "toolbox" to deal with the landmine threat in Bosnia.

Our countermine capability must be described in terms of the integrated application of doctrine, training, leader development, organization, and materiel. Because of differences of mines and their fusing (some 2,500 possible combinations world-wide), climatic conditions, soil types and mineral content, no single solution or single set of component solutions is possible. Often within a single minefield, there are varieties of mines and soils that require different countermine applications.

Developing soldier awareness is key. We train all soldiers to recognize and avoid mines. Most units within a combat zone are equipped with and trained in the use of mine detectors and

mine marking sets. Engineer soldiers are trained to conduct breaching and limited clearance operations. Armored forces are equipped with and trained to use mine rollers and plows that either detonate mines harmlessly or push them out of the way. The current engineer system of choice for minefield breaching is the M58 Mine Clearing Line Charge or "MICLIC." During dismounted operations, the primary technique is to blow the mine in place by sympathetic detonation. Explosive Ordnance Disposal (EOD) soldiers are trained to "render safe" or disarm mines and unexploded ordnance. EOD specialists respond when we cannot blow the mine or UXO in place. Because the Army has only a relatively few EOD units and specialists, their support is generally spread thin on an area support basis.

Soldiers receive UXO identification and hazard training during their initial entry training. This training is further reinforced during advanced individual training for engineers to include addition UXO and mine identification, marking, detection, and removal. Our engineer leaders are also trained as sergeants and Lieutenants in these same tasks as well as the mechanics of training, planning, and leading countermine operations. This initial individual training is continued once the soldier arrives at his unit. Our collective mission training plans cover detailed tasks, conditions and standard for countermine operations and these tasks are backed up with our doctrinal "how to" literature.

After initial training, soldiers are trained in their unit on the particular unit responses to mines and minefields.

Army units filter the plethora of training tasks through their mission essential task list or "METL". The METL is designed to simplify and focus the training requirements for units based on the tasks that they think they will most likely have to execute during wartime. Engineers focus on mine removal and breach training because these are some of their most likely and hazardous wartime tasks. Finally, prior to any actual deployment, we conduct mission training on the particular mine threat and effective countermine responses within that area of operations. The engineers have also trained other arms soldiers in mine awareness. Examples of this are the ongoing training taking place in Germany for all soldiers deploying to Bosnia and the training teams the US Army Engineer School has sent to both European and CONUS units to assist them in their predeployment training.

The US Army Engineer School, with "borrowed" experts from Program Manager, Mines Countermines and Demolitions, Night Vision Engineering Lab and the Joint Project Office-Unmanned Ground Vehicles, formed a Mobile Training Team that deployed to Germany to train the 16th, 23rd and 40th Engineer Battalions on

the use of three remote-controlled countermine systems- *Badger, Panther,* and a mini-flail. The Mobile Training Team also assisted in the installation and use of anti-blast or fragmentation protection blankets, Body Armor Individual Countermine (BASIC), and bolt-on protection kits for HMMWV and 5-Ton vehicles. Additionally, the team demonstrated developmental countermine equipment , such as, Thermal Mine Avoidance System TMAS, Barret Rifles w/explosive rounds and the Field Expedient Countermine System FECS (detonates magnetic fused mines).

The Badger system is designed to perform countermine route detection missions. *Badger* is a remote controlled 5-ton truck that mounts two IR cameras to detect mines thermally, a metallic mine detector head and a mine marking apparatus.

The Panther system is designed to perform countermine route detection, clearance and proofing missions. *Panther* is a remote- controlled M60 tank with mine clearing rollers.

The mini-flail is for dismounted soldiers. The mini-fail is a small, remote-controlled tractor that pounds short lengths of chain into the earth to detonate or destroy antipersonnel mines, thus clearing a 1 meter wide foot path for dismounted soldiers.

The Field Expedient Countermine System is designed to detonate magnetically-fuzed mines. The system mounts on the front of a vehicle and projects a magnetic field in front of the vehicle.

The Anti-Blast/ Fragmentation protection kits for HMMWV and 5-Ton vehicles were designed by ARPA for Somalia. The HMMWV kit includes front and rear exterior blast deflectors, interior floor pans for all four positions, armored front and rear seats, tail gate doors for all positions and ballistic windshields. The 5-Ton kit consists of external blast deflectors, cab(floor) fragmentation protection and energy-absorbing seats with four point personnel restraints.

The Thermal Mine Avoidance System (TMAS) is also known as "INFRACAM." The TMAS is a hand-held infrared camera capable of detecting surface laid and buried mines.

The Barret Rifle is a highly-accurate .50 caliber rifle designed to hit and pierce mine cases and detonate or otherwise neutralize mines.

There is no "silver bullet" to the complex mine threat. We train our soldiers and their leaders, write and apply effective doctrine, develop responsive organizations, and field a suite of high-, medium- and low-tech equipment. The Thermal Mine

Avoidance System is an example of high technology, the Barret Rifle of medium technology, and a simple mine probe-- low-technology. Each has its place and all these efforts assist and enhance field countermine operations. Our efforts are focused on developing an mine-aware and mine-alert soldier.

We believe that US Forces are trained and equipped in countermining to the best standards in the world.

In preparation for deployment to Bosnia, we have conducted rigorous mission-based countermine training. Units deploying and individuals designated for replacement or support within the area received training on the mine threat, recognition and detection, reporting and recording, and other actions prior to deployment. In addition to their countermine and other protective equipment, we have gathered up promising, but as yet not generally fielded equipment from many sources. The Army Engineer School is developing the techniques, tactics, and procedures for employing new equipment and is overwatching the testing community. Any equipment that shows significant promise is a candidate for "fast-track" fielding. A fundamental "truth" to how we wish to defeat mines is to seek increased distance and enhanced protection from the explosive device to the soldier. We are also using some robotics countermine technologies in Bosnia.

We have taken a host of measures to improve our capabilities from the standpoints of doctrine, equipment, and training?

The premier source of US Army countermine doctrine is Field Manual 20-32, *Mine/Countermine Operations,* published in late 1992 in the aftermath of the Gulf War . Key doctrine on unexploded ordnance is found in Field Manual 21-16, *Unexploded Ordnance (UXO) Procedures,* also revised and published after the Gulf War. The senior Army warfighting doctrinal publication is Field Manual 100-5, *Operations,* published in 1993. Doctrine provides the general framework by which we orchestrate military operations. We believe that our doctrine is sound. We have an engineer team in Bosnia that will provide doctrinal feed-back. Additionally, we have the networking capability in place to share specific and timely countermine techniques, tactics, and procedures. We believe that the troop list includes a doctrinally sufficient amount of combat engineers to conduct countermine operations beyond the capability of other US units in Bosnia.

We have also published the *Engineer Contingency Handbook (Former Yugoslavia)* that details the specific threat faced by our soldiers deployed to Bosnia. This publication provides color photographs of the mines that may be encountered as well as the techniques, tactics, and procedures that the belligerents

have used to lay mines. The information is vital to our soldiers' awareness of the threat.

Specific countermine equipment in the hands of our soldiers in Bosnia include the AN/PSS-12 mine detector, tank-mounted rollers and plows, the "MICLIC" rocket propelled line charge. Additionally, we have several developmental items in the field as described earlier.

The training has consisted of initial entry and advanced individual training that all soldiers and leaders receive, unit collective training, and specific mission training developed for Bosnia.

NATO has a common tactical countermine doctrine and we have borrowed freely from capabilities existing in other allied forces.

We actively share countermine initiatives among the NATO alliance and "borrow" good ideas from others. All NATO forces conduct similar countermine operations although there are minor differences in specific techniques, tactics, and procedures as well as equipment. NATO countermine doctrine is developed collectively through the NATO "panel" procedure. While there are no significant differences at the macro level, we certainly share many tactical ideas developed by our allies. As only one

example, we have used the Canadian engineer mine guide that they developed for their UN mission in the former Yugoslavia. Also, we are borrowing certain pieces of allied countermining and force protection equipment to see if we can gain even marginal improvement in the sets of specific countermine "solutions."

We have examined the countermine problem in a holistic manner, drawing talent and ideas from a diverse countermine community. The Engineer School is the primary combat developer with help from the Infantry, the Armor, and the Ordnance Missile & Munitions schools. The Army Materiel Command is the materiel developer with its executive agent, the Project Manager for Mines, Countermines, and Demolitions. Various Army labs participate in countermine initiatives as well as the testing community.

We feel that we have excellent flexibility to do whatever has to be done to protect our soldiers from the mine threat in Bosnia. Our basic thesis is that there is no single doctrine solution, no single training solution, nor organizational improvement, nor single piece of countermine equipment that will meet all countermine requirements. Any countermine measure touted as "the solution" is pure fantasy. In the long term, we believe that the United States needs to enhance funding for countermine programs in order to speed the fielding of promising systems.

We have recognized the particular challenge of the countermine challenge of Bosnia as well as other possible scenarios.

The most promising new technology currently in development is the stand-off minefield detection system or STAMIDS. STAMIDS will provide near real time locations of surface laid or scattered minefields and buried pattern minefields and, when combined with the Global Positioning System and an automated database, will provide accurate information critical to maneuver planning. The three variants of STAMIDS are based on platforms of aircraft or drone, ground vehicle mount, and hand-held.

Engineers, by virtue of their science-based profession, are practical men and women. While we strive for break-throughs, we identify barriers in technology, organization, and funding.

From a detection perspective, the optimum technology would be the ability to make the earth transparent to the depth of any mine and to give 100% assurance of the benign or malignant identity of any object buried in the earth or laid on the surface. And to determine all this from a distance that does not compromise the safety or security of the soldier employing such a system.

Mr. WELDON. Colonel Barlow.

STATEMENT OF COL. DENNIS BARLOW, USA, DIRECTOR FOR POLICY AND PLANS, HUMANITARIAN AND REFUGEE AFFAIRS, OFFICE OF THE ASSISTANT SECRETARY FOR SPECIAL OPERATIONS/LOW INTENSITY CONFLICT, DEPARTMENT OF DEFENSE

Colonel BARLOW. Good afternoon, sir. It is great to be here.

The heart of the testimony today is going to be the technology. But we also realize that you have a question about the basic use of the U.S. military forces to do this operation. I am the Director of Policy for the Office of Humanitarian and Refugee Affairs in the Office of the Secretary of Defense.

My oversight responsibilities pertain to humanitarian assistance programs and operations, transportation of nonlethal DOD excess property, migrant and refugee issues, emergency relief operations, certain arms control negotiations and humanitarian demining.

The United States policy for humanitarian demining in Bosnia is reflected within the Dayton agreement. Each of the parties is responsible for demining activities within its territory. These programs will be augmented by the U.N. Department of Humanitarian Affairs, which will facilitate the effective coordination of civilian humanitarian demining efforts. Thus, humanitarian demining in Bosnia will be overseen by the civilian United Nations [U.N.] hierarchy there.

IFOR has involvement in humanitarian demining in three ways: All operational and tactical mine clearing will be done to area clearing standards approaching 100-percent effectiveness, a degree of safety often associated with humanitarian demining, vice the military breaching standards of 80 percent. Two, all information on mine locations collected by IFOR will be made available to agencies and organizations involved in humanitarian demining. Three, selected units or detachments may support mine awareness efforts.

Based on the information provided above, we do not anticipate using the IFOR to conduct humanitarian demining operations or training for host nation personnel.

That concludes my statement, sir.

Mr. WELDON. Thank you, Colonel.

We will begin questioning. Let me begin by just generally asking you—my experience in looking at these kinds of situations goes back to Kuwait, when I was in the country a week after the liberation of Kuwait and the entire city was just loaded with mines and the French were taking a lead role there. From my understanding, there were some very crude mines that were put there by Saddam's forces.

Mr. Reeder, would you start off by explaining the operation of some of the mines? You have a little show and tell there. I know there are some that pop up and then explode that do more damage. Just kind of explain the way they operate for us. I want to go to the whole issue of nonmetallic mines, so perhaps you could begin and discuss that also in some of your explanations of the types of mines.

Mr. REEDER. OK, Mr. Chairman.

Just to sort of start off, in general, antipersonnel mines have a variety of effects. And when we talk about effects, what we mean are that lethal element that translates between the mine and its target.

In general, most antipersonnel mines have between 100 and 200 grams of Trinitratoluene [TNT] in them, and the mines in the former Republic of Yugoslavia pretty much follow that thought process. They range from a simple pressure-fused mine where just downward pressure of about 5 kilograms would set the mine off, to a variety of different types of stake-mounted mines, often with dual fuses, pressure and trip wire as well.

The difference between these two devices is pretty straightforward. A contact mine causes damage basically to the absolute immediate area around the mine. A fragmentation mine, or a bounding fragmentation mine operates in a similar manner but jumps up to an optimum height to disperse fragments have lethal radiuses between 15 and 30 meters, depending on the weight of the mine. These are pretty heavy weight as far as these categories go. They are about 20 to 25 meter lethal radiuses.

On antitank mines, basically, you have two main lethal mechanisms. In the former Yugoslavia, the vast majority are similar to this one in that they are blast, about 6 kilograms of TNT.

There are a much lesser number of antitank mines that have a warhead that forms on that explosive effect and actually flies towards a target. TMRP–6 is what was considered by the UNPROFOR forces the most dangerous antitank mine in the region. Simply, it is a belly attack antitank mine. When you either roll over it with pressure or you function the tilt rod, a mild steel plate is formed that actually flies up through the belly, and this will defeat any tank fielded in the world today.

More importantly, because this has a flier plate, you can take this mine and mount it sideways in an embankment and use either the tilt rod or a trip wire to launch this flier right out into a roadway area. So in other words, it can attack from the side.

An important point to keep in mind with the former republic of Yugoslavia, because they had such a wide variety of special devices, booby trap devices, and demolition devices, is that basically they are all compatible with each other. You can take a simple mine fuse and put it in an explosive block, which this is a replica of, and you now have either a trip wire fuse, or in this case you have got a device that can be ratcheted up under a stair tread, and if you step on the stair, just a 1½ millimeter deflection would set this block of explosive off.

So as you can see, there is quite a wide range of devices available.

As far as detectability goes, probably 75 percent of the buried antipersonnel mines are difficult to detect, and what we did is——

Mr. WELDON. Excuse me. Is that because they are nonmetallic?

Mr. REEDER. Well, basically, you have to be cautious here. Many mines nowadays are made out of plastic material, so from an appearance point of view they appear to be nonmetallic. What is really important, though, is the amount of metal components within the fuse itself. It is rather difficult to see in this cross-section, but you can see that underneath this fuse itself there is a thin cylinder.

I have a sample one in my hand. Basically, this is about a 1-gram cylinder of aluminum. It is equivalent to what you might call a blasting cap or a detonator, and the other standard size is less than half of that, about four-tenths of a gram. In many of these mines, that is the range of the metal content that you have. That is below the threshold that we have established several years back. It makes these a category we describe as difficult to detect.

All of these mines that are used over there have some amounts of metal in them, and they vary anywhere from four-tenths of a gram up to mines like this that quite obviously have a tremendous amount of metal in them.

The difficulty with a low-metallic-content mine is that often you can detect it but you have to be very cognizant of your procedures, the amount of training that a man has had, his mental alertness, the terrain conditions, snow cover, grass or shrub growth. So, in other words, you really have to be extremely cautious with all of your procedures. And as I said, many of the mines in this country are in that category, where you have to really stay on top of your procedures.

The good news is that under the right conditions, they are all detectable mines.

Are there any other points, Mr. Chairman, before I get too carried away describing these mines?

Mr. WELDON. We received information that the Army did some testing this past year on a hand-held system that was primarily designed for low metallic or perhaps plastic mines, and that it had an effective rate of somewhere around 70 percent.

Is that true? My understanding is that it was not—it is not being deployed in Bosnia because the level of reliability is not higher than 70 percent. Is that in fact the case, and at what level would, in fact, we deploy something like a hand-held system?

Mr. REEDER. I would really have to defer the total answer on that because—for this reason: As a technical analyst in landmines, it is my mission to identify those things that need to be considered by our military planners, by our doctrine people and our equipment developers. So we have highlighted the situation with the landmines. Now it is up to our laboratory systems and our engineer folks to actually run tests, and they can describe more fully the tests and the results they have run, based on the situation with the mines.

Mr. WELDON. I will ask that same question, the technical part, but, General Gill, do you have any comments on that from the requirements standpoint?

General GILL. I would tell you that 70 percent is not good enough; that there is nothing over there now that they have not chosen—the command has not chosen to accept something with that kind of a level of resolution. But we are working very hard on those kinds of technologies that will bring that stuff to fruition.

So, again, we are back to this—this suite of solutions that use our metallic mine detectors and all the things that we can put in a soldier's head to make him alert and aware.

Mr. WELDON. What would be an acceptable level, up in the 90-percent range or 100 percent range, from a requirement standpoint?

General GILL. It depends. This is a requirements type of issue, but I help define requirements. We are under the 99-point-something percent. Again, it depends on what you are doing. We are willing to accept—for breaching operations, that's an under-fire combat type of thing where we have to move through an obstacle, a much lesser degree of assurance that the mines are removed. And then we try to improve on that by proofing the lanes with skimming soil and things out of the way by running mine rollers across it and so forth.

Under those kinds of conditions, we will accept something probably—hopefully, a little better than 70 percent. But when it comes to mine clearing an area that you are going to be in where you have soldiers at risk, we want to be as assured as we possibly can be that we have got them cleared.

Mr. WELDON. Thank you. Just one other question before I go on, and that is relative to the accuracy of the data regarding the mine location and numbers. I think we have indicated that we feel we have some good data, but I have also heard that some of the mine laying techniques were simply hand-setting, I think is what you said, Mr. Reeder, which would mean we would have no way of knowing perhaps where they were put. So how accurate? I mean, are we talking about an accuracy level in the 1990's?

Mr. MAZZAFRO. Sir, that is hard to characterize. I would be reluctant to say it is in the 90-percent range. As I said, we have a broad general sense of where the mines are because of where the war was. That is where you would expect the mines to be. We are getting the data from the factions, which by and large is confirming that presupposition where they are.

As Mr. Reeder says, and as I indicated, we already know from the debriefs and the information that we are getting, that some minefields were never recorded. Some of the recordings were lost, some of the recordings were fragmentary, and some of the mines were randomly placed. But, again, as with any operation or any situation, you have got to go with some presuppositions, and the presuppositions seem to be holding up that you would expect the mines to be in the area of operations along lines of confrontation, and that is what the data seems to show, sir.

Mr. WELDON. Thank you.

Mr. SISISKY. Can I?

Mr. WELDON. Mr. Sisisky.

Mr. SISISKY. Thank you, Mr. Chairman, and thank you gentlemen for being here.

I am a little confused. What is the problem in developing mine detection and mine destruction? I remember 12 years ago, either it was the sense of Congress or—I know I raised the issue, because the Marine Corps had told me that more people die from mines than any other thing in war. I just don't understand if there is metal in there, why we can't develop something. If you don't have the money, I wish you would tell us. But it just seems to me if we can develop high-technology aircraft, high-technology nuclear things, if we can go to the moon, certainly we can do something with mine detection and mine destruction.

What is the Army doctrine for mines? Is it to bypass and mark those things as we go to war? What is the Army doctrine? There

is something that I cannot figure out in my mind—I have been after this for years, and where is the problem? If it is money, please tell us. Maybe we can get the money. It is too late for Bosnia, but I was told we have developed something.

You know, we have hand-held things. That was World War II, wasn't it, where we—well, I was told that we have got the ultimate thing where we dig up the mines, we just go deep and dig them up. You know, give me a break. I just can't believe that. And I would just like to know what the real problem is and how do we protect our troops from that.

General GILL. Sir, let me start that. Mines are things that are built by human beings, who have intent to use them against other humans and vehicles, and they have many different ways of concocting these things. We have problems—metal detection is a technology which we use fairly well, but then we have the nonmetallic mines.

Mr. SISISKY. With some metal in them, am I correct?

General GILL. Well, there are mines in the world—and Mr. Reeder can explain that—that have none. Those that have some are still a problem because you have got to get very close to them to see it. We have a great many promising technologies to try to do things, but we are dealing with a problem that is as complex as the people who build the mines, as their methods of emplacement, be they tripwires, be they putting them under magnetic influence or pressure, stepping on them, coming down from the trees. There are so many different ways that you can put these things in. So any single technology that is looking down at the ground may not solve the problem if it runs into a tripwire.

Then we have the problem of climate and weather and soil. If we dealt with the homogenous mass of dirt, that would present one problem for locating the mine, but if we are dealing with lots of different conditions out there and climate that changes over time, frozen ground, falling ground, and so forth. Every one of these things presents us a new problem.

So the solution to the thing, at the moment, is to go back and defeat each one of those things with somebody who is very well trained, using his equipment, staying as far away from the mines as he possibly can put himself, and being very, very careful.

Mr. SISISKY. Well, you know, that is very good. I have looked at the infantryman of the next century and what we have done with the digital battlefield.

General GILL. Yes, sir.

Mr. SISISKY. And I have looked at that and that is surrounded with a lot of problems. As a matter of fact, the weight has been cut in half in 1 year of a computer. I mean, the technology is there. And I am talking about detection in the same way that——

General GILL. I am about at the end of my expertise. I think the technology panel has got a lot more to say about this.

Mr. SISISKY. That may not be the problem.

General GILL. If I could defer to them, unless Mr. Reeder wants to add something.

Mr. REEDER. Just the only point I might make is that it is always enjoyable to deal with Marine Corps personnel. They have a very pragmatic view on life, and they do consider the encountering

of landmines—business as usual. So I do have to agree with you, the Marine perspective is very straightforward.

Mr. SISISKY. That is why I asked about the Army doctrine.

Mr. REEDER. And I think that the right answer is that we should let our technologists address this. You are correct there is an awful lot of work going on with computer processing and signal processing that they will probably discuss.

Mr. SISISKY. That is it.

Mr. WELDON. Thank you, Mr. Sisisky.

I would just add that each of the past several years, the Congress has actually increased funding over what was requested in this area because we felt that more of an emphasis needed to be placed on mine operations and R&D necessary to deal with these issues, as Mr. Sisisky raised, I guess, a few years ago.

Mr. Evans.

Mr. EVANS. Mr. Reeder, over the last few months, of course, the seriousness of the mine threat in Bosnia has become obvious. What can you predict in terms of how serious the threat will be to our Armed Forces in the conduct of this current operation?

Mr. REEDER. Thank you, Mr. Evans. Projections are tough, but here is, I think, my call on this: Bear in mind what I said about the preparation by our senior leadership and by the engineers in theater. That comment that I made was very heartfelt. I mean, it is, to me, astounding the work the theater has done to prepare for this mission.

Oftentimes, as a technical expert on landmines, I feel that here sitting stateside, I often have a better perspective than people, say, in the country affected. I don't feel like that at all in Bosnia. As a matter of fact, I am very comfortable sitting back, taking a back seat, and letting the theater do what they are obviously doing very well.

To me, the most important thing that must be accomplished over there is to draw together all the sources of data. In a country by the name of Eritrea, under the humanitarian demining program, we tried to start an information fusion process, a historical research process, that would go out and gather this information.

That kind of a concept is critical in Bosnia. And the thinking is right along those lines already. So as long as that can be supported by the proper decisions and funding, I am pretty optimistic because, again, the first thing that you have got to do is come to grips with where those mine locations are. Even if they have been cleared, they need to be identified, because those mines that have been—minefields that have been cleared are just as suspect as the ones where the mines are still located. All those have got to be addressed by the properly trained personnel.

Above and beyond that, landmines are going to be a problem that we will face operationally in the theater along with other things, and we will continue to have a smattering of incidents. I am afraid—it is unfortunate, that there is no way around it. But the emphasis that I have seen over there, to me, is just absolutely amazing. I cannot eloquently state it, as a matter of fact.

So I have to be optimistic, Mr. Evans, I really do.

Mr. EVANS. I understand you have developed this mine facts CD which now has a subsequent edition, I understand, and that it was

funded through some of our funding through the humanitarian demining program?

Mr. REEDER. Actually, what we have done within the intelligence community, because we also feel that this is an extremely critical task, we have over the years put out about 40 or so major publications, many of them in unclassified versions. I have them here in front of me on Eritrea, Mozambique. We have a wonderful document out now on Angola which has mine locations as best as we can chart from this place, from this side of the ocean; Somalia. And all of these kinds of documents came out of our own data bases down at National Ground Intelligence Center.

From those data bases, we dumped the data down into the Mine Facts CD–ROM, and then also a new one that is just out. This particular one was not DOD-funded but it is a compilation of many other aspects of the global demining program as well as the technical data in mine facts.

Mr. EVANS. Has it been provided, either one of these compact disc [CD's], to our troops in Bosnia?

Mr. REEDER. These have all gone through the standard distribution, but I think the humanitarian demining program can address, upcoming in a little bit, that that kind of product is being tailored to go out to the troops. And General Gill, I think, is—go ahead, sir.

General GILL. Sir, one of the tools that one of my predecessors put together, along with a lot of help from the Science and Technology Center, and allied nations I would add, a great cooperation with all the allies involved in UNPROFOR, is an engineering contingency handbook for the former Yugoslavia. The handbook was originally put out in 1993. It was a best seller. It has grown to be a much bigger best seller now, to the tune that we have shipped since last summer 4,800 copies of this document; color photographs, pictures, techniques. It is a wonderful tool to assist the people, the leaders, and for the leaders then to train their soldiers.

I think the idea of a CD–ROM in Bosnia is a little bit far for 1996. But I would tell you that I spoke with Colonel Hawkins, who is the First Armored Division engineer and has the responsibility in that sector for collecting the information. I spoke to him on Monday, and his report to me was that he was impressed with the cooperation of the warring factions and with the general accuracy and goodness of the minefield reports that they brought him.

He had over 3,000 of them recorded at the time. And as they are recorded in their data base, they are not just—it is not just a docile data base. They are linked to all of their little subunits to include nodes that are out with the Russians and the Nordics, where they push this information out to them. So as they get a minefield report in an area, it goes out to everybody in the field to know where it is, be aware of it, and if they are in the area, to try to get some assistance from the warring factions to mark it and begin the clearing operation. So a little bit of high tech is entering the business.

Mr. EVANS. Thank you, Mr. Chairman. I appreciate it.

Mr. WELDON. Thank you. We will adjourn the session briefly while we vote on the DOD authorization conference report. Following that, Mr. Bartlett, you will be the first member to question.

Mr. WELDON. I would like to reconvene the subcommittee for continuation of the hearing. Next in order of questioning is Congressman Roscoe Bartlett.

Mr. BARTLETT. Thank you. I want to thank our chairman for convening this hearing and thank all the witnesses for appearing.

Since we have not gone to Bosnia as combatants and should not be fighting, to what extent can we simply minimize this problem by going where we wish to go and avoid most of the potential problems?

General GILL. I think you have hit on our strategy, our policy. We go where we must go. We need to have mobility. We have asked the former warring factions to do all of the work to clear the areas where we need to go. We will attempt to mine roll and proof and do things to ensure those areas are in fact clear, but discipline and control of where we are going is key to bringing us back unscathed.

Mr. BARTLETT. I would just like to note for the record that this is one of the areas where the Congress has authorized and appropriated funds in addition to that requested by the Pentagon in past years. We are sometimes criticized because we sometimes authorize and appropriate moneys in addition to what was requested by the Pentagon. I was impressed with the statement that our ability to detect these mines is imperfect at best, and I am pleased that this committee has had the foresight in past years to appropriate additional moneys for this, because if it weren't for that, we would be even in a poorer position to ensure the safety of our personnel.

I hope that this kind of thing becomes more and more publicized so that the American people understand they have a committee here that is genuinely interested in not just the security of our country but in the security of those that provide for the security of our country, and I am pleased that we have had the foresight to both authorize and appropriate additional moneys for this area in the past several years.

Thank you very much for being here.

General GILL. Thank you, sir.

Mr. WELDON. Mr. Peterson.

Mr. PETERSON. Thank you, Mr. Chairman. I appreciate you having this panel together, because I think this is very important. I was rereading the purpose, and that is to really acquaint the members here on what the threat really is out there.

I also want to reiterate something that I think this panel has said to us, and that is that we are not in this alone. Other countries have demonstrated significant interest and have provided a great deal of research and development [R&D] by virtue of the fact that most of our equipment over there in the detection area is from Austria, I think the AN–19P or whatever it is.

General GILL. Yes, sir.

Mr. PETERSON. They actually may be in fact ahead of us, some other countries, so our cooperation in that regard, I think, is commendable, and we need to join hands as we use our funds to develop this.

But I want to settle on this 5 minutes with really an analysis of this threat. The threat to me seems to have been minimized by great training, No. 1, and the innate knowledge of every soldier out

there. It is not just the hierarchy that knows about it. It is not just CD's being passed out. It is not the manuals. It is the fact that these individuals out there are sensitized to the danger.

The other part of it is that there are 2 million mines. However, our area of operation is relatively small, as I understand it, and that we are not inclined to take our mine clearing or demining or whatever we are talking about beyond those areas of operation from which we intend to be—that is, those areas of separation. So I would like for you to really, if you can, lock in, if you give me a 1 to 10, what the threat really is to our troops, and then another couple of little questions.

Nobody is talking about booby traps, which shocks me. I thought that they had been laying booby traps all over, and clearly this is not showing up as a major threat.

Then, finally, when we separate these troops. As they pull back, they are leaving and hopefully identifying their old minefields. Are they reestablishing new minefields in the next level of defense for themselves or not? In other words, are they just leaving those and then implanting much more in the process?

So it is kind of a rambling series of questions, but can you take a shot at that and give me a little feel for this, given that our purpose here is to focus on what the real threat is? Have we maybe exaggerated it a little bit, and then maybe not so exaggerated and we just minimized it, mitigated it, by the training and some of the preparatory work that we have done?

Captain MAZZAFRO. Congressman, let me start with the last question, which is new fields, from a surveillance-intelligence standpoint.

Normally, when you have someone in my business here we are talking about, usually, all locked up in a different room, all sorts of whiz-bang, terrific sensors that will help us do things. They are certainly in play, and they are working every day, as we would expect. We have a terrific advantage in this theater because we have a large number of people literally on the ground, patroling these zones of separation which have been cleared, by and large, almost in the 90-percent range in accordance with Dayton on January 19.

The zone of separation is being flown on a daily basis by 1st Air Cav, or by ground patrols and that sort of thing. So if someone were laying new minefields, I feel relatively confident what we would catch that. We would know, would detect that.

There are no indications of that, because I think there is a war weariness we are seeing showing up in the press and we are seeing in the reports we are getting back, in the debriefings that we are getting from people we are coming in contact with. On the political side, there is no one particularly interested in wanting to be the breaker of the Dayton agreement, at least in the short term. And of course it is winter, which is not when you would expect the mines to be laid.

All of these forces come together and give me a high degree of confidence to be able to tell you that I do not think new minefields are being laid, certainly in any significant number or in any significant place. Oh, someone could be placing an errant mine that is booby trapped, certainly, but is there a generated policy to do this? No, sir; I feel fairly confident that is not the case.

What the threat is, I can describe from an intelligence standpoint. But the perspective is much better given, I think, from General Gill's standpoint: what it feels like to sit in the field as opposed to an intelligence analyst in Washington.

General GILL. I am familiar with what I know about mines, back about 20 or 30 years, and what I hear about the mines over there, we tried to explain as I was going on.

Congressman Sisisky's question is multifaceted. There are antipersonnel mines. There are antitank mines. There are antitank mines that have been turned into antipersonnel mines, et cetera. On and on and on and on in all the different evil ways that you think about that you might booby trap them and make them work.

My sensing of what is going on, what I hear from the people in the field, is that the warring factions are now cooperating with us. As long as they continue to cooperate, and they think that we are carrying the big stick and it is in their interest to participate with us, I think we will be very successful. Again, we may have the problem of some splinter element that disagrees with that and goes off and gets involved in some kind of an incident, be it a mine incident or a sniping incident or something like that; but if the climate is right, they will quit mining.

My Vietnam experience tells me that where you understood that the population was friendly and interested in you, they didn't booby trap and they didn't put in minefields; and where you got into hostile areas, then you had not only to clear the route the first time but also the second time, the third time, and the fourth time, and that is a much more difficult problem which I hope we don't get into.

Mr. PETERSON. If I may, Mr. Chairman, is it safe to say though at this juncture—given, one, cooperation; two, preparation; three, surveillance—that our original concept of the threat is significantly reduced from that anticipated?

Mr. REEDER. I think I will throw back a phrase that you yourself used in your remarks, sir, and I think it is absolutely appropriate, and that is "minimize—minimize by knowledge."

I would have to add, for General Gill and for the Engineers' School, that our doctrinal concepts and the approaches we deal with: if mines are developed such that a mine is booby trapped, it really doesn't matter to the soldier dealing with the mine; in other words, we try to establish procedures so that we always treat them that way. We destroy them, regardless of whether they were booby trapped, so that those booby traps can't affect us.

That leaves booby trapped buildings or booby trapped equipment. And I must be remiss, I didn't try to bring out the fact that booby trapping has happened, and it has in specific areas been rather intensive. But, again, the idea is that we try to control the situation, to develop procedures that let us safely do that.

I am quite certain that the R&D folks will tell you about dogs that sense explosives, that are available in-theater. So there are some very good actions that have been taken that in conjunction with our training procedures to minimize that threat. And that really is the key point.

Mr. PETERSON. Thank you for being clear, and I appreciate the extra time, Mr. Chairman.

Mr. WELDON. Mr. Skelton.

Mr. SKELTON. You know, I do not care about your doctrinal concepts. What kind of capacity do we have to deal with the threat today? That is the issue before us. After it is all said and done, how safe are our troops over there today? What can you do? What is on the shelf? What is available that you are not using? Anybody.

General GILL. Sir, we are using everything we have in the inventory that the command feels comfortable using, bringing forward. We do not traditionally run around with rollers, because it kind of gets in the road of mechanized warfare, and so forth. But they have taken all the rollers out, trained on using them. Everybody has got them and there is no shortage of them, although we are still deploying there.

We are not full up over there yet. There is a lot of equipment arriving today and tomorrow. There are six mine dog detection teams that are in Germany. They are due to deploy in theater within this next week. So there is a lot of stuff flowing in there that will add to what they already have.

But I hold to my position that following the accords ruthlessly, assiduously, making the warring factions do the things that they must do, keeping our soldiers away from the areas that are even suspect, will protect our forces, barring error.

Mr. SKELTON. Could the incident where the young man from Maryland was so severely injured, could that have been avoided, from your knowledge of it, General?

General GILL. Sir, I am told that he had a route, and he erred, made a mistake and turned down a road that was known to have been mined. And you know, just in common terms, he screwed up. I also understand—and this is, maybe I can be backed up by others—that he was in an armored or armor-protected Humvee, and for that he owes his life. So it is a little bit of we are very thankful that he is alive and that is all of the bad that happened. We are very sorry that he made that error.

Captain MAZZAFRO. The other interesting fact is, the Bosnian Serb Army [BSA] forces in the area were trying to flag him down off the road, which speaks to the issue of cooperation.

Mr. SKELTON. What, General, could we in this committee do to help keep our troops safe in this mission that they have undertaken?

General GILL. Sir, I will not advocate a throw money at the problem kind of thing. I will tell you that expressing the interest of the American people that they are concerned about their sons and daughters over there, your personal involvement in this issue through this committee and through the other work that you do, clearly puts a great deal of pressure on us to do our job, to do it to standards and to get all the equipment over there.

There is, to my knowledge, nobody in the force that has said, "I need something," that it has been an issue that it costs too much money. It is only an issue of "where can we find it, who has it, how can we get it here." If we keep that attitude up through this entire operation, God willing, we will come back with an intact force and an absolute minimum of——

Mr. SKELTON. Some of the saddest occasions that we have had in this committee have been hearings on incidents that have gone

awry, some very sad ones, and I commend the chairman, both the chairmen of these two subcommittees, for holding this hearing and bringing this to your attention and letting you know of our interest. The last thing we would like to have is a hearing for you and others to explain why some bad things happened.

Now, on a more positive note, General Gill, thank you. Especially, I would like for this committee to know that you are the commandant of the finest Army engineering school in the world. It is in Fort Leonard Wood in the Fourth Congressional District, and I am very pleased to welcome you here. Thank you. This is a political commercial. Thank you.

Mr. WELDON. Thank you for that commercial, Congressman Skelton.

And, Congressman Bateman, I understand you are yielding back.

Congressman Hunter, chairman of our Procurement Subcommittee.

Mr. HUNTER. Thank you, Mr. Chairman.

I want to add my commendations, Curt, for your holding this very important hearing.

Gentlemen, let me, since I haven't been here for most of the hearing, apologize. We have had the remake of the defense authorization bill on the floor, in which the leadership was once again excoriated by some Members for increasing defense spending. But some of that increased defense spending this year and over the last several years has gone to mine detection. I know you may be a little grateful for that at this point.

I go back to Desert Storm, and my question has to do with the defense acquisition system that mine detection equipment must necessarily go through to be procured. As you know, and we are all familiar with, it is a fairly difficult and tedious defense acquisition system to procure anything in DOD, whether it is a simple system, or an aircraft, or an artillery piece.

In Desert Storm we needed a certain weapons system fairly quickly to bust bunkers, and my understanding is that we put the requirement out, invented the solution, built the solution, and utilized it in combat in only 14 days.

Now, that is because we didn't go through all the hoops and hurdles of the defense acquisition system. We would still be in the third stage of development of that system if we had taken it through the normal course. We did that because this was an emergency. We had to do certain things in Desert Storm and do them quickly, and because of that, we went to the skunk works out in California and got some of the old graybeards out there, came up with an invention quickly, built it quickly, deployed it, and used it in combat.

You have a similar emergency, as I understand it, with respect to these nonmetallic mines, because we do not have a great system for clearing nonmetallic mines.

So my first question to you would be, have you elevated this requirement to the same level that they elevated several weapons requirements during Desert Storm, where they said: "I do not want to have a giant labyrinthical defense acquisition system in front of me, because I have got people out there who are going to be wound-

ed or killed if we wait for years and years to develop this; I want something quickly"?

Have you really pressed aggressively through an accelerated system to acquire what you need? First question. Are you trying to get this stuff as fast as you can?

General GILL. Sir, you need to ask the research and development [R&D] panel. That is out of my line. I have a requirement out there to build detection equipment for minefields. We have been pressing that, I mean forever, to get better systems to do that sort of thing. Again, it is a technology issue.

Your question kind of is, are we doing it hard enough and do we have the right kind of pressure, technology, people and money and all that sort of stuff, focused on the problem. I think they can answer that better.

Mr. BACHKOSKY. Mr. Hunter, if I can, we will answer that question later, if I can do it. We will answer that.

Mr. WELDON. We will ask that question of the next panel.

Mr. HUNTER. During Desert Storm when we needed this bunker buster, Congress wasn't involved in that. The war-fighting theater commanders said, "We have got to have this; we have got to have it now." They went out and procured it for them in a few weeks' time, it was flown over, and it was used in combat. That is the kind of pressure we may need, and the kind of circumvention of this very tedious system we have all constructed for defense acquisition, in order to protect your troops. So you may consider that.

The other question I would ask you simply is, Are you aggressively soliciting the innovation and the systems that the private companies have out there? Because I know there are a lot of private companies that say, "Hey, we have got something we think will solve the problem." Is the door open for anybody in this country who thinks they have got the answer to come in and make this pitch?

General GILL. Sir, I would tell you, only from my personal experience, that the door is very open and we are extremely receptive. Not a week, possibly not a day goes by that I do not have some offer of some system that we then go and investigate, or go back to our category of, is this something we really need, will this solve a problem? And if it will, then the next step of that process is, well, let's go find out. Again, the procurement and R&D guys who follow me on the second panel will be able to get very specific with that.

Mr. HUNTER. Just one last caveat. If we follow the standard procurement system in developing a nonmetallic detector, it will be years before we even have a prototype available for testing under our standard time schedules. Do you understand that?

General GILL. Yes, you are correct.

Mr. HUNTER. Unless you do something extraordinary, maybe we do something extraordinary, Bosnia will be long gone, the amputees will be recovering at home before the system is fielded.

General GILL. Correct.

Mr. WELDON. With that, we will move to Mr. Kennedy.

Mr. KENNEDY. I would like to thank the panel for their testimony. Although I have not been able to hear it personally, I have gone through it. It has been of interest to me, given the fact that it seems, in the threats that we are facing globally, there seems to

be the issue that no matter what Commander in Chief [CINC] may be out there, each CINC has this as an issue that they are concerned about.

I would like to ask the panel what the different CINC's have said about this and what they have done to pressure or press the development of technology to deal with this problem. I mean, this is not a new problem. Every CINC sees it, and they have to have had a plan to incorporate it, a way to either get around it or to deal with it in their operational manuals, and I would be interested to find out today what they have been doing. Maybe there is something other than what you have said.

General GILL. Let me take it this way. Most of the CINC's are concerned about a threat, and the threat is an attack of an offensive nature that they have to defeat—stop and then defeat. In the tactical sense, when you get to the mine problem, if we are not mining we are talking about clearing or breaching, and we have a completely different set of problems, a different set of probabilities and so forth about breaching a minefield, the minimum effort that we can make to get quickly through an area where he has probably got us under fire.

That is a big CINC issue, and we have systems under development, promising systems, prototypes. They are still several years away to assist us getting or solving that particular problem. There may be some spinoffs from that technology that help this problem of clearance of minefields, but that is not the direct CINC pressure that we get, other than we now have Commander in Chief, European Command [CINCUSEUCOM] who is very interested in this Bosnia issue.

Mr. KENNEDY. It seems to me there has been—I cannot speak from the long perspective of this, but breaching these minefields is going to be a challenge of every CINC. I mean, you think about what we may be called on to do in our various humanitarian efforts, peacekeeping, peace enforcement, this is going to be an ongoing issue for us.

Maybe, Colonel, could you tell us about what may be the humanitarian programs that have been done so far that have helped, and what we have learned from those in moving us forward in dealing with this problem?

Colonel BARLOW. Yes, sir, I would be glad to do that.

About 2 years ago our humanitarian demining program got started, and to this point each of the regional CINC's has verbalized, through cables and whatever, back to the Joint Staff their interest in this program.

We do not do the operations. We train the trainers to be able to do demining, and right now we have operations going in nine countries. These operations are, I will call them economy-of-force operations, because it only takes a few people, generally special operations folks. In the case of Cambodia, for instance, about 27 special operators for 2 years have been there training the local Royal Cambodian Army to do demining operations.

We find that the CINC's are saying that this is an integral part of their peacetime campaign plans. It gives them a kind of influence and access, and the special operators and others who go in there are able to learn about this area of operations. So for a rel-

atively low input in terms of dollars and folks, we wind up getting not only a lot of good feedback. Our folks like to get that kind of feedback—knowing they have done well.

Mr. KENNEDY. It offers a training medium for our military in the field. But in addition to that, more importantly than ever, it gives us the bridge to those areas, where if we are ever called upon to be deployed, we already have an immediate communication going with those militaries that will prove to be the difference in whether we know where these fields are and where they aren't.

Colonel BARLOW. I think that is absolutely right.

Mr. KENNEDY. I would like to go back to what I know has been the question that has been most asked already. And that is, How do we move the R&D into procurement so that we can get the best, you know, detection equipment out there? In that respect, the problem with the technology is that while it is good, it is not foolproof.

I would be anxious to hear from your perspective. It has got to be 100 percent, I imagine, and that is the problem with this. Or does it have to be 90 percent? Or when you are talking about demining and clearing areas, or declaring it an area that has been breached, from your sense of comfort, how do you address that? Do you address it from a 90-percent perspective, 100 percent, or where do you draw the line?

General GILL. The breaching requirement under fire in combat is significantly less than 100 percent, but we proof it. The clearing mission from a military viewpoint—we will clear the minimum essential area necessary to conduct our operations and protect our force. Those areas that are not cleared, we will properly mark. Marking mine fields is a very key force-protection and humanitarian-protection issue.

For humanitarian demining, we don't use our troops. We do use our explosives ordnance disposal [EOD], our explosives ordnance disposal people. They are the experts in actually removing mines. We use the bulk of our forces in detecting, marking, and often blowing in-place minefields, we just consider that too hazardous to put soldiers at risk.

Mr. KENNEDY. I want to follow on another question that Mr. Skelton raised: What is out there to protect our troops? As I understand it, those protected Humvees that saved the life of one of our service personnel that was injured already in Bosnia was something that was not deployed until very recently—retrofitting the Humvees so they had that armor.

General GILL. In the old days we would have filled sandbags and put them around and on the vehicle, and so forth, but that is a crude way to get the job done. So that was a solution to a Somalia problem: to go out and develop a system that was more highly armored and protective. In fact, that is what saved this soldier's life.

Mr. KENNEDY. How has that gone forward in terms of procurement?

General GILL. I need to have the procurement people answer that. I do not buy any Humvees.

Mr. WELDON. We are going to have a second panel, and we will get into that procurement issue.

Mr. KENNEDY. Oh, I am sorry. OK. Thank you very much for your testimony.

Mr. WELDON. We are very pleased to welcome the distinguished chairman of the full committee, our good friend, who just had a very successful vote on the House floor, Mr. Spence.

Mr. SPENCE. I don't have any questions.

I want to thank you for having this hearing and thank you gentlemen for appearing on the panel to help us, and all the ones on the other panels, too. It is a very meaningful hearing we are having. It is very timely and concerns a great many people, obviously. We appreciate all you are doing. Thank you.

Mr. WELDON. Thank you, Mr. Chairman.

Our final questioner before we go to panel two is Mr. Taylor.

Mr. TAYLOR. Thank you, Mr. Chairman.

General Gill, I apologize if this question has been asked already, but I would like to ask it. Is there any evidence in Bosnia that in areas that you knew to be previously cleared that mines had shown up after clearing operations. Any evidence of new mines being put out in the American or allied sector?

General GILL. Let's get the intel view on that and then I will pick up on the incident.

Captain MAZZAFRO. The short answer is no, but it is incomplete because we don't have enough data. We haven't been there long enough, checking the mines. As the forces are deployed, they will be primarily involved in getting themselves over the Saba River and setting up in the camps. As General Gill pointed out earlier, we have been trying to verify the minefields where we are actually living and operating on a daily basis.

We are just now beginning to go out to the lines of separation, because the forces have moved back from those confrontation lines in accordance with the Dayton agreement on the 19th of January. We are now just beginning to patrol those areas and beginning to check those areas where the parties have said no mines have been cleared. We are now beginning to check those areas again.

In accordance with the strategy that General Gill has articulated, we are going to go where we have to go, not going to go just to see if there is a mine out there. If there is a reason to go, we are going to go and check.

As I said at the beginning, my answer is no but it is a caveated no, but the caveat is we just don't have enough data to give you a strong, confident no. When they tell us there is not a mine, that there won't be one there, there hasn't been so far.

General GILL. We are very concerned about this issue. We had a wake-up mine incident recently. One of our armored vehicles hit a mine like this one here. The area had been proofed. The theory they have come up with is that weathering, the age of the mine and a number of other things caused this mine not to explode when they rolled across it. So we dodged the bullet there. There is an increased sense of awareness that there just are no perfect solutions.

Mr. TAYLOR. The spring thaw, does that present any new problems or does that make your job easier?

General GILL. I will rely on my old-time experience. The problem you may get with spring thaw is that things move around, just as water moves around. That is the bad news. The good news is the snow cover and the frozen conditions that inhibit some of our detection will go away, so in a sense the detection mission ought to be

a little bit easier, and the visibility and all the other factors. You use all of your senses and equipment to detect these mines.

Mr. TAYLOR. But to date, you have no evidence of roads that have been previously cleared or areas that have been previously cleared where someone snuck in?

General GILL. Nothing to date.

Mr. TAYLOR. I have no further questions.

Mr. WELDON. Just in closing, one final question: Which country, if any, has the lead responsibility in Bosnia for the demining operation? Is it, in fact, the United States, or is it apportioned according to where the countries are assigned, for their troops, or is it all one responsibility?

Colonel BARLOW. It is apportioned to the area.

Mr. WELDON. Our responsibility is limited to those areas where our troops are, in fact?

Colonel BARLOW. But we have a responsibility, or at least we have pointed out, not the DOD, but the U.S. Government is working with the UNDHA to work out the civilian humanitarian demining portion. We have the Bosnia executive committee working on coordinating that through the United Nations, the civilian side.

Mr. WELDON. But we are not, in fact, responsible alone? There are other countries that are involved. What other countries, the Brits, the French?

Colonel BARLOW. And the Brits, yes, sir.

Mr. WELDON. Three of us really taking the lead.

Captain MAZZAFRO. I would add, as an aside, that on the intelligence side we have gotten a tremendous amount of information on the basis of Norway's experience. They used to operate in the American zone. They are still in the American zone, and this experience and intelligence on what is what and where things are has proved very useful.

Mr. WELDON. I want to thank you all for your excellent testimony. We appreciate you coming in.

You know the commitment of this Congress to this issue by the attendance at this hearing. We would just encourage you to speak out loudly and clearly for whatever it is that you feel we need in theater. You will get it. There will not be any second-guessing of the requests made.

The second panel will talk with us about the broader issue of R&D to get you the technology you need.

We thank you for coming, and we will now convene our second panel.

Mr. WELDON. Our second panel consists of John Bachkosky, Deputy Under Secretary for Advanced Technology; George Singley, Deputy Director, Defense Research and Engineering; A. Fenner Milton, Deputy Assistant Secretary of the Army for Science and Technology; Brig. Gen. Roy Beauchamp, Deputy Chief of Staff, Research, Development and Engineering, U.S. Army Materiel Command; John Reingruber, Assistant for Science and Technology, Office of Assistant Secretary of Defense (Special Operations/Low Intensity Conflict); Dr. Claude Manley, Deputy Director, Navy Joint Explosives Ordnance Technology Division, U.S. Navy Surface Warfare Center; and Dr. Michael McD. Dow, Acting Director, Board on

Science and Technology for International Development, National Research Council.

General Beauchamp, it is a privilege to have you here.

I would just like you to know, Mr. Skelton—I just want you to know General Beauchamp, who before his new assignment, was a very successful leader in Philadelphia.

Welcome to all of you. We are very pleased to have you here. Your statements will be accepted in the record. We would ask you to keep your presentations as brief as possible so we can have time for questions.

And to get to the nitty-gritty of what we are doing, research and development, we will start with Mr. Bachkosky.

STATEMENT OF JOHN M. BACHKOSKY, DEPUTY UNDER SECRETARY OF DEFENSE, ADVANCED TECHNOLOGY

Mr. BACHKOSKY. My name is Jack Bachkosky. I am the Deputy Under Secretary of Defense for Advanced Technology.

I really appreciate the opportunity to appear before your committee. I hope that my associates and I will be able to address your concerns regarding the landmine threat in Bosnia. We will focus principally on our efforts to evaluate new technologies that could be developed and deployed to improve the countermine capabilities of U.S. forces in support of Operation Joint Endeavor.

With respect to that operation, we have established a procedure to ensure our forces have access to those systems and mature technologies that have the potential to reduce or eliminate that landmine threat while enhancing the effectiveness of our forces.

Our overall objective is, where possible, to enhance our military capability with equipment that is acceptable, is available in the timeframe that is consistent with the United States commitment in Bosnia, and does not place an unacceptable burden on the commanders in theater.

We have taken steps to ensure that the services, OSD agencies and staff elements coordinate all efforts to introduce new systems and technologies to the forces involved in Joint Endeavor. It is clear that while we want to enhance the capability of our joint forces, we also want to ensure we minimize disruption by not introducing technologies with systems that may not be sufficiently mature or are of minimal value.

We have established this procedure in coordination with the Joint Staff, the services and the defense agencies to achieve these objectives. Military operational needs that are the result of unique joint endeavor environment, operations, or hazards will be forwarded through the normal operational chain of command to the Joint Staff, who will prioritize these needs, forwarding them to Dr. Kaminsky and his group for action. Within the office of the Secretary of Defense, Mr. John Phillips, the Under Secretary of Defense for Logistics, will be responsible for evaluating proposals to our logistic support capabilities. I have a similar responsibility to meet the prioritized needs of our Bosnian support forces in the area of technological support.

We look to the DOD science and technology community, other Government activities, and, as Mr. Hunter pointed out earlier, industry and our allies to provide these solutions. Recommendations

for deployment of any new capability will be presented to the Under Secretary of Defense and the Joint Staff before deployment.

Another of my responsibilities is the management of the advanced concept technology demonstration [ACTD] programs. This is an effort that has been established to provide a means of rapidly transitioning promising technologies from the developers to the operational users.

Again, in response to Mr. Hunter and Mr. Kennedy, to your questions, we have, in fact, been able to move technology from the laboratory to operational use in a matter of months. The one example that I think you may be familiar with, is the Predator system. The Predator system was conceived in late 1994. The request for proposal [RFP] went out on the street in March 1994. We had the first system flying in June and July 1994 and, frankly, we deployed that system to Bosnia a year later and it has performed exceptionally well in Bosnia. We are about to redeploy in March of this year.

So we can do that. In fact, the ACTD concept has been set up specifically to address the kind of issue you are alluding to. So that we don't take years but rather we take months or possibly days. And we think we have been successful in doing that.

One of the things we are looking at in this context is some of the efforts we have going on in technology now to address the countermine problem. The ACTD's allow the war fighter and the user to evaluate military technology, the military utility of the technology that is emerging from our scientific programs. It also permits them to develop concepts of operation for employment of that new technology in a theater of war.

Key among the ACTD's that my office now has under way is a joint countermine ACTD which was initiated in fiscal 1995. This ACTD is a coordinated effort between the Army, Navy, and the Marine Corps. It is focused on conducting seamless mine countermeasure operations from the sea, through the surf zone, and on land. This will be accomplished by integrating Army, Navy, and Marine Corps mine-detection technology along with currently fielded military equipment.

The ACTD leverages these technologies to both detect and neutralize mines that may be found, and those programs that are being conducted within the individual services. Key mission areas are mine surveillance, reconnaissance, detection, and neutralization. The current plan is to conduct a countermine ACTD demonstration in fiscal year 1997 and another that is more focused on ocean and surf zone in fiscal 1998. We have looked at this. It does not appear possible or practical to accelerate the ACTD in support of Bosnia.

Even though I make that statement as far as it relates to the joint countermine ACTD, there are individual technologies that may, in fact, be candidates for Bosnian support. The Army under Brigadier General Beauchamp, whom you will hear from shortly, has been conducting an investigation to determine if any of the novel technologies in the ACTD, or elsewhere, might be deployed in support of Operation Joint Endeavor. This effort is concentrated on the needs of the Army forces which will be operating in Bosnia.

Similarly, I have had ARPA conduct an assessment of those technologies that are being pursued in Office of the Secretary of De-

fense [OSD] agencies, the national laboratories, Federal funded research and development centers [FFRDC's] and industry that may also have countermine application. Both of these studies have been conducted in consideration of the threat, the mission in Bosnia, the maturity of the technology that is being looked at, the training and supportability requirement that may be necessary in order to employ that technology in theater. We will be reviewing the outcome of both of these efforts within the next 7 to 10 days and making appropriate recommendations to Dr. Kaminsky and the Joint Staff.

In order to provide you with an understanding of how the DOD science and technology activities address and may apply to the countermine needs, I will be followed by Mr. George Singley, Deputy Director of Research and Engineering, who will discuss the Department's plans for future countermine technologies.

He will be followed by Dr. Fenner Milton from the Office of the Secretary of the Army, who will address the Army efforts to respond the technological challenge of mine countermeasure operations.

General Beauchamp from the Army Materiel Command will provide an overview of their activities in the fielding of support ability of Army countermine systems.

Mr. Reingruber, of the Office of Low Intensity Conflict, will address the Department's demining capabilities.

Our last witness, who is not from the Department of Defense but from the National Research Council, is Dr. Mike Dow.

Once again, I want to thank you for the opportunity to be here today. I hope the information we provide will lead you to conclude we are doing everything possible to provide our forces with the most effective countermine technology and systems available; that our activities are closely coordinated across the Department of Defense, from research through acquisition; and that we have established a procedure that will permit us to respond to critical needs and take advantage of technical breakthroughs. With your continued interest and support, we can ensure our forces are equipped with the most advanced and relevant technologies and are properly trained to maximize their potential.

[The prepared statement of Mr. Bachkosky follows:]

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Mister Chairman, Members of the Subcommittees, and Staff, thank you for the opportunity to appear before you today. I want to discuss our technology efforts in response to the landmine threat in Bosnia. It gives me particular pleasure to appear together with my associates, each of whom are key individuals in our coordinated effort to identify new technologies which could be developed and potentially procured in order to improve countermine capabilities of both U.S. Forces participating in Operation Joint Endeavor in Bosnia and, additionally, might support future Bosnia-like operations. It is clear to all of us that the mine threat in Bosnia represents a significant operational and technical challenge.

As the Deputy Under Secretary of Defense for Advanced Technology I am specifically charged with assuming responsibility for oversight of Advanced Technology Development Programs designated for exceptional management attention because they represent technologies which might be of significant value in addressing needs. In accomplishing this task I coordinate and work closely with the Joint Staff, the Joint Requirements Oversight Council (JROC), the Unified Military Commanders, individual Military Service operational and science and technology leaders and the key Department of Defense research and technology agencies such as the Advanced Research Projects Agency.

I employ the Advanced Concept Technology Demonstration (ACTD) process to accomplish my responsibilities. Established in 1994, the ACTD process is

playing a significant role in revolutionizing the DoD technology transition process and in ensuring the Department can respond quickly and effectively to today's dynamic military needs. ACTDs are designed to rapidly transition promising mature technology from developers to operational users. Each ACTD represents a close teaming between both the technological and operational communities of the Department of Defense. They are clearly user oriented and I take particular efforts to ensure they are user driven. In each ACTD, the operational military user is the key individual charged with ensuring that the technology under evaluation is relevant to the mission or task at hand and that it in fact can be operated and supported under field operating conditions. Each ACTD is an integrated effort to assemble and demonstrate a significant, new and improved military capability based upon mature advanced technologies. Typically we will conduct a series of exercises or operations at a scale size adequate to establish both the operational utility and system integrity of the technologies under evaluation. ACTDs allow the warfighting user to:

- Evaluate a technology's military utility before a commitment is made to acquisition.

- Develop concepts of operation for employment of the new technology.

- If the technologies under evaluation represents a "value added" to the warfighter the ACTD will allow retention of a low cost residual capability available for future military operations.

It is important to note that ACTDs are not a replacement for our formal acquisition process. Rather, they are a means to permit the military user to evaluate new technologies, assess their operational impact and enable our military forces to make more informed acquisition decisions.

To date the Department has initiated twenty ACTDs. Ten were begun in Fiscal Year 1995 and an additional ten commenced in Fiscal Year 1996. Perhaps the most visible ACTD has been the Predator Medium Altitude Endurance Unmanned Aerial Vehicle (UAV) which began in Fiscal Year 1995.

Another key ACTD is the Joint Countermine ACTD. Initiated in Fiscal Year 1995 this ACTD is a teaming between the operational and science and technology communities of the Army, Navy and Marine Corps. The objective of the Joint Countermine ACTD is to demonstrate the capability to conduct seamless land and amphibious mine countermeasure operations from sea to land. The demonstration will be accomplished by integrating on-going Army, Navy and Marine Corps technology developments along with fielded military equipment. As such this ACTD leverages mine countermeasure and neutralization technology investments of the individual military services and laboratories and will demonstrate an integrated, seamless capability. This ACTD will demonstrate coupling of selected current countermine capabilities with developing

technologies, leading to an improved integration and enhancement of joint countermine capabilities. A key goal of the ACTD is identify and evaluate operational concepts and doctrine in Mine Countermeasure and Countermine operations involving both Operational Maneuver From the Sea and follow on land operations. Key mission areas considered will be mine surveillance and reconnaissance on both the sea and land, mine and obstacle clearance of both the sea and land. and overt mine reconnaissance, detection , neutralization and clearance operations.

The Joint Countermine ACTD consists of two closely connected demonstrations. Demonstration I, planned for Fiscal Year 1997, focuses on near shore capabilities with emphasis on in-stride mine detection and neutralization of mines and obstacles in the beach zone and on the land. Demonstration II, planned for Fiscal Year 1998 emphasizes surveillance and reconnaissance and stresses a "seamless" transition of countermine operations from the sea, through the surf zone and across the land.

The United States Atlantic Command in Norfolk, Virginia is the operational sponsor for the Countermine ACTD. Management of the technical challenges, including the individual mine detection and neutralization technologies under review, the requisite simulation to support mission planning and assessment and the command and control links is under the cognizance of an ACTD Joint

STATEMENT BY

JOHN M. BACHKOSKY

DEPUTY UNDER SECRETARY OF DEFENSE
(ADVANCED TECHNOLOGY)

TO THE

SUBCOMMITTEE ON MILITARY PROCUREMENT

AND

SUBCOMMITTEE ON MILITARY RESEARCH AND DEVELOPMENT

OF THE

HOUSE NATIONAL SECURITY COMMITTEE

JANUARY 24, 1996

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SECURITY COMMITTEE

Program Office under the co-sponsorship of both the Army and Navy and staffed by representatives of the Army, Navy and Marine Corps. The Joint Program Office was established in Fiscal Year 1995.

In view of the significant mine threat in Bosnia, the Army has been conducting an assessment to determine if there is any new technology that might be mature enough to be considered for use in the Operation Joint Endeavor in Bosnia. Since the ACTD leverages individual military service investments in mature countermine technologies, it has been a key element in the Army assessment. In particular, this effort has concentrated on the Army and Army forces which will be operating in Bosnia. This review has considered not only the maturity and potential of specific technologies, it has also evaluated these technologies and their relevance to counter the threat and support the mission in Bosnia. Factors such as conditions within the theater, technological maturity, training requirements and system supportability in field were, and continue to be under evaluation. This assessment effort will continue as a potential source of support and enhanced countermine technology to support Bosnia and future Bosnia-like operations.

With regard to the present operations in Bosnia one of the key objective of the Department of Defense is that U.S. Forces supporting Operation Joint Endeavor have access to those systems and mature technologies which will improve their

effectiveness and reduce or eliminate risk and exposure to hazards. We believe strongly it is equally important that we guard against providing equipment that does not satisfy the criteria I just mentioned, is not available in a timeframe consistent with the U.S. commitment, is not supportable with available resources or places an unacceptable burden on the military commanders. While we understand that there may be technologies which might be of value we are working to establish a process to both evaluate these capabilities and minimize the disruption that might be caused while attempting to help our forces in theater. The Department believes it imperative that the Services, OSD agencies and staff elements coordinate on all efforts to introduce new systems or technologies to our forces involved in Joint Endeavor.

Accordingly we have established a process to evaluate all technologies or equipment which might support Joint Endeavor but have not yet been subject to formal acquisition review or approval. Military operational needs that are the result of the unique Joint Endeavor environment, operations, or hazards will be provided directly through the normal operational chain of command to the Joint Staff. The Joint Staff will serve as the point of contact for reviewing all Joint Endeavor needs.

Within the Office of the Secretary of Defense and under the leadership of the Under Secretary of Defense for Acquisition and Technology (USD/A&T), the

Deputy Under Secretary of Defense for Logistics (DUSD/L) will be responsible for evaluating proposals to improve logistics support capabilities. I, as the Deputy Under Secretary of Defense for Advanced Technology (DUSD/AT), am responsible for identifying and evaluating potential solutions to address all other operational needs. The solutions may evolve from the DoD Science and Technology effort, other government activities, industry and other sources. Both DUSD/L and DUSD/AT will coordinate with each other, the Joint Staff and the appropriate Military Services.

The purpose of this policy in support of Operation Joint Endeavor is to ensure that we provide the most militarily relevant, technologically mature systems in a manner which ensures minimal disruption to our forces within Bosnia and does not detract from their mission in support of the Dayton Accord. The Department must be certain that technology upgrades provided to the theater, whether to enhance countermine detection operations or other missions, are sufficiently mature and supportable and that they provide value added to our forces in theater.

Once again thank you for the opportunity to address the Committee today. I look forward to working with you and providing you with information so you may fully understand both our policy and the technologies available to enhance our operations. With your interest and support we in the Department of Defense can

ensure our forces are equipped and trained with the most advanced, relevant technologies available to support dynamic and challenging operations such as Operation Joint Endeavor. Thank you.

Mr. WELDON. Mr. Singley.

STATEMENT OF GEORGE T. SINGLEY III, DEPUTY DIRECTOR, DEFENSE RESEARCH AND ENGINEERING, DEPARTMENT OF DEFENSE

Mr. SINGLEY. Mr. Chairman, I sincerely appreciate the opportunity to appear before you again, particularly on such an important issue as countering the grave landmine threat confronting the United States and our allies around the globe.

As Deputy Director of Defense Research and Engineering, I am responsible for the formulation, planning, and review of the Department of Defense Science and Technology Program. I work closely with the science and technology executives from the military departments and defense agencies to ensure the programs are of high quality, responsive to military needs, and well coordinated to preclude unnecessary duplication. I also chair the executive committee that directs the Defense Science and Technology Reliance effort to improve coordination, collaboration, and joint planning of the service and agency programs, to include the countermine program.

During the past 4 years, we, in the research and development community, have better focused, with your help, and intensified our efforts to improve our ability to detect and clear mines over large areas with high confidence. Following Desert Storm, we restructured the Army countermine science and technology program to better concentrate on remote mine detection and neutralization.

In another related action to strengthen our countermine science and technology program, we took advantage of the Base Realignment and Closure Commission in two instances. One I will talk about later in terms of Jefferson Proving Ground; second, we combined a countermine program which had been at the Belvoir Research and Development Center, combined that with the night vision electronic sensors which you have heard about already.

To support our forces in Somalia, we rapidly dispatched the countermine project officer from the Advanced Research Projects Agency and a team of engineers from the Countermine Division at the Night Vision Electronic Sensors Directorate. They went to Somalia and helped our soldiers use the very latest technologies available for hand-held and vehicle-mounted detection.

To address systems integration and to speed technology transition to the field, the Joint Countermine Concept Technology Demonstration just mentioned was created, sponsored by the U.S. Atlantic Command and managed by a joint Army-Navy-Marine Corps project office. This program will have war fighters use several different maturing technologies to determine which are the most effective and operationally suitable at detecting and clearing individual landmines and minefields. These real-world experiments will also investigate the tactics, techniques, and procedures to make best use of these advanced systems.

Although our investments in countermine technologies and concepts are to meet military requirements, we must also recognize that they may also be useful in doing other tasks, such as detecting and clearing unexploded ordnance.

In 1994, with the strong support of Congress, we initiated a project to evaluate innovative systems and technologies for the detection, identification, remediation of buried, unexploded ordnance. The project was managed by the U.S. Army Environmental Center, while the U.S. Naval Explosive Ordnance Disposal Technology Division provided the technical lead.

A 120-acre controlled test site at Jefferson Proving Ground containing inert ordnance and nonordnance and debris was established. The result confirmed the difficulty of detecting and identifying buried ordnance and mines, with acceptable false alarm rates. The tests also reinforced the importance of testing proposed hardware and software before committing to acquisition.

Research in advanced sensors, sensor fusion, and automatic target recognition is critical to improving our ability to detect and identify buried metallic and nonmetallic mines with fewer false alarms. We are also investing in research to improve our understanding of the physics of mine detection and neutralization.

We recently released a broad agency announcement soliciting proposals from the Nation's university community for multidisciplinary research to produce new technologies, for remote, reliable detection, and neutralization of mines during combat and operations other than war. It is anticipated this will result in at least one award of $1 million for up to 5 years.

We are working closely with our allies in this area through the North Atlantic Treaty Organization [NATO] Defense Research Group and our partners in the technical cooperation program, the United Kingdom, Canada, Australia, and New Zealand. I am the U.S. representative to both bodies, and I can tell you, based upon my discussions in both bodies in the last 6 months, this is a very hot topic, as you can well imagine, in those bodies as well.

We are exchanging information and we are doing collaborative programs together, working with the joint staffs, services, and agencies, and building on the results of ongoing joint war fighting capability assessments. We are also preparing the first joint war fighting science and technology plan. It contains our resource-constrained strategy and plan for providing the future joint war fighter with the technology and the advanced systems to achieve 12 selected joint war fighting objectives. One of these is joint countermine.

If I could digress from my prepared remarks a little bit, what we will be doing is, we will be laying out for the first time, from research all the way to technology transition, what our different technological paths are and what the demonstrations are and what advanced concept and technology demonstrations are needed, so we can be assured we are, in fact, transitioning that technology. It will certainly bring an increased level of visibility to joint countermining.

In response to H.R. 104–131, dated June 1, 1995, we are in the process of selecting an existing organization to become the Department of Defense executive agent for area ordnance clearing. Our plans in this area are being strengthened as you requested. We are improving the focus and coordination of this important program with initiatives like the defense science and technology reliance,

our technology area plan, and like our new joint war fighting science and technology plan.

Increased funding in this area since 1994 has allowed us to enhance the demonstration and evaluation of promising technologies from industrial and Government laboratories. Research funding will sponsor this Nation's universities to seek breakthrough technologies to make progress faster.

Your continued interest and support for our countermine science and technology efforts are very much appreciated and essential to accelerating solutions to our future forces.

Thank you very much.

[The prepared statement of Mr. Singley follows:]

PREPARED STATEMENT BY:

GEORGE T. SINGLEY, III

DEPUTY DIRECTOR
DEFENSE RESEARCH AND ENGINEERING

TO THE

SUBCOMMITTEE ON MILITARY PROCUREMENT

AND

SUBCOMMITTEE ON MILITARY RESEARCH AND DEVELOPMENT

OF THE

HOUSE NATIONAL SECURITY COMMITTEE

JANUARY 24, 1996

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Until Released by the Committee

Mr. Chairman and Members of the Committee, I appreciate the opportunity to appear before you again, particularly on such an important issue as countering the grave landmine threat confronting the United States and allied forces around the globe.

As Deputy Director of Defense Research and Engineering, I am responsible for the formulation, planning and reviewing of the DoD science and technology program. This includes all basic research, exploratory development and advanced technology programs. I work closely with the Science and Technology Executives from the Military Departments and Defense Agencies to ensure that programs are high quality, responsive to military needs and well coordinated to preclude unnecessary duplication. I chair the Executive Committee that directs the Defense Science and Technology Reliance effort to improve coordination, collaboration and joint planning of the Service and Agency programs, including countermine.

During the past four years, we, in the research and development community have better focused and intensified our efforts to improve our ability to detect and clear mines over large areas with high confidence. Following Desert Storm, we restructured the Army countermine science and technology program to concentrate on remote mine detection and neutralization. To support our forces in Somalia, we rapidly dispatched the Countermine Project Officer from the Advanced Research Projects Agency (ARPA) and a team of engineers from the Countermine Division of the Night Vision and Electronic Sensors Directorate. They went to Somalia and helped our soldiers use the very latest technologies available for handheld and vehicle mounted mine detection. A handheld thermal imaging device proved effective at detecting shallow mines and explosive devices recently buried in the roads. A vehicle mounted Forward Looking Infrared (FLIR) device was effective but it necessitated a slower than needed forward speed. This device was found to be most effective during the pre-dawn period because of the thermal contrast between the road surface and subsurface disturbances at this time of the day.

To address systems integration and to speed technology transition to the field, the Joint Countermine Advanced Concept Technology Demonstration was created. This program is sponsored by the U.S. Atlantic Command and managed by a joint Army/Navy/Marine Corps project office. This program will have warfighters use several different mature technologies to determine which are most effective and operationally suitable at detecting and clearing individual landmines and mine fields. These real world experiments will

also investigate the tactics, techniques and procedures to make best use of these advanced systems.

Although our investments in countermine technologies and concepts are to meet a military requirement, we recognize that they may also be useful in doing other tasks such as detecting and clearing unexploded ordnance. In 1994, with the strong support of Congress, we initiated a project to evaluate innovative systems and technologies for the detection, identification and remediation of buried unexploded ordnance. The project was managed by the U.S. Army Environmental Center while the U.S. Naval Explosive Ordnance Disposal Technology Division provided the technical lead. A 120 acre controlled test site containing inert ordnance, nonordnance and debris was established. Airborne, ground vehicle and man-portable systems were demonstrated. Sensor technologies evaluated included magnetometer, ground penetrating radar, electromagnetic induction, and infrared sensors. Target detection software and remediation technologies were evaluated. The results confirmed the difficulty of detecting and identifying buried ordnance and mines with acceptable false alarms rates. The tests also reinforced the importance of testing proposed hardware and software before committing to acquisition.

Research in advanced sensors, sensor fusion and automatic target recognition is critical to improving our ability to detect and identify buried metallic and non-metallic mines with fewer false alarms. We are also investing in research to improve our understanding of the physics of mine detection and neutralization. We recently released a Broad Agency Announcement, soliciting proposals from the university community for multi-disciplinary research to produce new technologies for remote, reliable detection and neutralization of mines during combat and operations-other-than-war. It is anticipated that this will result in at least one award of $1 million/year for up to five years.

We are working closely with our allies in this area through the NATO Defense Research Group and our partners in The Technical Cooperation Program, the United Kingdom, Canada, Australia, and New Zealand. I am the United States' representative to both bodies.

The Department's program for the development, demonstration and transition of technology to counter the land and littoral mine threat is summarized in the DoD Detailed Technology Area Plan for Conventional Weapons, dated May 5, 1995. Working with the Joint Staff, Services and Agencies and building on the results of the ongoing Joint Warfighting Capability Assessments, we are also preparing the first Joint Warfighting Science and Technology Plan. It contains our resource-constrained strategy and plan for providing the future joint warfighter with the technology and

advanced systems to achieve twelve selected joint warfighting objectives. One of these is joint countermine.

In response to HR 104-131, dated 1 June 1995, we are in the process of selecting an existing organization to become the Department of Defense Executive Agent for area ordnance clearing. Our plans in this area are being strengthened as you requested. We are improving the focus and coordination of this important program with initiatives like Defense Science and Technology Reliance, our Technology Area Plan and the new Joint Warfighting Science and Technology Plan. Increased funding in this area since 1994 has allowed us to enhance the demonstration and evaluation of promising technologies from industrial and government laboratories. Research funding will sponsor this Nation's universities to seek breakthrough technologies to make faster progress.

Your continued interest and support for our countermine science and technology efforts are very much appreciated and essential to accelerating solutions to our forces.

Mr. WELDON. Dr. Milton.

STATEMENT OF A. FENNER MILTON, DEPUTY ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY, DEPARTMENT OF THE ARMY

Mr. MILTON. Mr. Chairman and members of the subcommittees, thank you for the opportunity to appear before you to discuss the Army's countermine science and technology program.

I am Fenner Milton, Deputy Assistant Secretary of the Army for Research and Technology. It is a privilege for me to represent the Army leadership and the men and women of the Army science and technology community.

I will provide an overview, while Brigadier General Beauchamp of the Army Materiel Command will provide programmatic details. Brigadier General Beauchamp is leading a technology integration cell that is examining the applicability of all levels of countermine technology to our challenges in Bosnia. He will discuss the support we are providing our forces in the field.

Because mine warfare is a casualty producer at all levels of conflict, we have protected our countermine science and technology investment in this era of declining resources. Our S&T investment includes research, exploratory development, and advanced development, including a joint advanced concept technology demonstration [ACTD], mentioned earlier.

Land countermining is one of the most difficult challenges we face. We firmly believe that no single technology will provide the answer. Only a system-to-system solution will provide adequate capability, and to that end, the Army has taken steps to concentrate its technology development efforts at the Countermine Division of the Communications-Electronics Command, where an integrated, mission-oriented approach is being pursued. This avoids compartmentalization by technology.

The Countermine Division is part of the Night Vision and Electronics Sensors Directorate, so that this group has easy access to the most sophisticated sensor technology for the particularly important mine detection and neutralization problem.

Mr. MILTON. Dr. David Heberlein, who heads this division, is here today to help answer questions. Other Army research and development centers and laboratories are called upon to provide component technology support.

The Countermine Division is, however, responsible for determining the applicability of these technologies, those provided by other services and agencies and those developed specifically for demining and unexploded ordnance removal. This is important because at the basic technology level these efforts often overlap.

Dr. Heberlein is also responsible for the execution of the congressional special interest program and technology applicable to humanitarian demining in support of the Assistant Secretary of Defense for special operations and low intensity conflict. Mr. John Reingruber of that organization is here today to discuss humanitarian demining.

The Army S&T program in land countermine has always been closely coupled to that of the U.S. Marine Corps. This has involved a number of jointly funded efforts and joint technology evaluations.

For example, the Army and the Marine Corps have jointly funded the off-route smart mine clearance advanced technology demonstration of ATD and the vehicle-mounted mine detection ATD. Because of these circumstances, the Army is particularly pleased to participate in the joint countermine ACTD, which is seeking a system-of-systems countermine solution and ties us even more closely to the Marine Corps and Navy efforts.

Within the countermine technology program, we also closely track the unexploded ordnance efforts being pursued by the Army Environmental Center in conjunction with the Naval Explosive Ordnance Disposal Technology Division. All this work is for quite a different application than mine detection and neutralization. Our close interaction assures that promising unexploded Ordnance [UXO] technology can be evaluated in the countermine program.

The Army S&T program has been particularly successful in that it has transitioned important technologies to the project manager, mines, countermines, and demolitions for formal development.

For example, the stand-off airborne detection advanced technology demonstration [ATD] transitioned in fiscal year 1992 to the Airborne Stand-off Mine Detection System Demonstration and Validation of Demval Program.

Also, the explosive neutralization technology demonstration transitioned in August 1994 to the explosive stand-off minefield breacher demval program. In fiscal year 1996, the successful demonstration of the hand-held close-in man-portable mine detection system transitioned to the hand-held stand-off mine detection system demonstration validation program.

The transition of these successful technology efforts into formal development will enable the Army to put significant new capabilities in the hands of our operational forces.

I am joined here today by my colleague Brigadier General Beauchamp of the Army Materiel Command. He will provide additional information on the countermine during the course of our testimony this afternoon.

Thank you very much.

[The prepared statement of Mr. Milton follows:]

RECORD VERSION

STATEMENT BY

DR. A. FENNER MILTON

DEPUTY ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY

OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY

FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

BEFORE THE

MILITARY PROCUREMENT SUBCOMMITTEE

RESEARCH AND DEVELOPMENT SUBCOMMITTEE

COMMITTEE ON NATIONAL SECURITY

UNITED STATES HOUSE OF REPRESENTATIVES

ARMY SCIENCE AND TECHNOLOGY PROGRAM

RESPONSE TO THE LANDMINE THREAT IN BOSNIA

24 JANUARY 1996

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ON NATIONAL SECURITY

DR. A. FENNER MILTON

Deputy Assistant Secretary for Research and Technology
Chief Scientist
Office of the Assistant Secretary of the Army
(Research, Development and Acquisition)

Dr. Milton was appointed to his present position in July 1995. He is responsible for the Army's entire Science and Technology program, spanning 21 laboratories and research, development and engineering centers, with approximately 10,000 scientists/engineers and an annual budget of $1.4 billion. He is also the principal scientific advisor to both the Secretary of the Army and the Assistant Secretary of the Army Research, Development and Acquisition.

He came to the Pentagon in September 1990 as the Director for Technology in the Office of the Assistant Secretary of the Army for Research, Development and Acquisition. In that position he managed the office that prepares the Army's Science and Technology program inputs to OSD and Congress and oversaw the Army's Exploratory Development (6.2) and Advanced Concept and Technology Demonstration (ACTD) programs.

Before coming to the Pentagon, Dr. Milton spent 5 years as the manager of the Electro-Optics Laboratory of the General Electric Company in Syracuse, New York. There, he developed semiconductor components for passive infrared sensors and laser systems and conducted demonstrations of advanced sensor concepts. In particular, InSb and MCT IR focal plane arrays were delivered to IR search and track and missile threat warning programs.

In 1984 and 1985, Dr. Milton was Vice President for Policy and Operations of the Roosevelt Center for American Policy Studies in Washington, D.C. At this privately funded public policy research institute he managed studies associated with Space Defense and the Federal Deficit.

Prior to 1984, Dr. Milton was the Branch Head of the Electro-Optics Technology Branch of the Optical Science Division at the Naval Research Laboratory (NRL) in Washington, D.C. At NRL, Dr. Milton's research interests included integrated optics, fiber optics, IR focal plane arrays, clutter rejection signal processing and laser countermeasure systems.

After receiving his Ph.D. in Applied Physics from Harvard University, Dr. Milton worked from 1963 to 1971 as a member of the technical staff of the Science and Technology Division of the Institute for Defense Analyses (IDA) where he conducted theoretical research in semiconductor physics and advised ARPA concerning IR sensor and high energy laser programs.

Dr. Milton serves as Chairman of the National Infrared Information Symposium (IRIS) and has published extensively concerning integrated optics and focal plane arrays. He is also principal author of Making Space Defense Work; Must the Superpowers Cooperate, a technical and policy analysis of strategic defense, published by Pergamon-Brassey in 1989.

Mr. Chairmen and members of the Committees, thank you for the opportunity to appear before you to discuss the Army's countermine Science and Technology (S&T) program. It is a privilege for me to represent the Army leadership and the men and women in the Army science and technology community. I will provide an overview, while BG Beauchamp of the Army Materiel Command will provide the programmatic details. BG Beauchamp is leading a technology integration cell that is examining the applicability of all levels of countermine technology to our challenges in Bosnia. He will discuss the support we are providing to our forces in the field.

Because mine warfare is a casualty producer at all levels of conflict, we have protected our countermine science and technology investment in this era of declining resources. Our S&T investment includes research, exploratory development and advanced development, including a Joint Advanced Concept Technology Demonstration.

The multiplicity of the threat, the infinite variety of employment options and range of environmental conditions serves to make land countermine one of the most difficult challenges we face. We firmly believe that no single technology will provide the answer. Only a system-of-systems solution will provide adequate capability. To that end, the Army has taken steps to concentrate its technology development efforts at the Countermine Division of the Communications-Electronics Command, where an integrated, mission-oriented approach is being pursued. This avoids compartmentalization by technology. The Countermine Division is part of the Night Vision and Electronics Sensors Directorate, so that this group has easy access to the most sophisticated sensor technology for the particularly important mine detection and

neutralization problem. Dr. David Heberlein, who heads this Division, is here today to help answer questions. Other Army research and development centers and laboratories are called upon to provide component technology support. The Countermine Division is, however, responsible for determining the applicability of these technologies, those provided by other Services and Agencies, and those developed specifically for demining or unexploded ordnance removal to the countermine problem. This is important, because at the basic technology level, these efforts often overlap.

Dr. Heberlein is also responsible for the execution of the Congressional special interest program in technology applicable to humanitarian demining, in support of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict (ASD/SOLIC). Mr. John Reingruber of ASD/SOLIC is here today to discuss humanitarian demining.

The Army S&T program in land countermine has always been closely coupled to that of the United States Marine Corps (USMC) . This has involved a number of jointly funded efforts and joint evaluations. For example, the Army and the USMC have jointly funded the Off-Route Smart Mine Clearance Advanced Technology Demonstration (ATD) and the Vehicle-Mounted Mine Detection ATD. Because of these circumstances, the Army is particularly pleased to participate in the Joint Countermine Advanced Concept Technology Demonstration (ACTD) which is seeking a system-of-systems countermine solution and ties us even more closely to USMC and Navy efforts.

Within the countermine technology program, we also closely track the unexploded ordnance (UXO) efforts being pursued by the Army Environmental Center

in conjunction with the Naval Explosive Ordnance Disposal Technology Division. While this work is for a quite different application than mine detection and neutralization, our close interaction assures that promising UXO technology can be evaluated for use in the countermine program.

The Army S&T countermine program has been particularly successful in that it has transitioned important technologies to the Project Manager, Mines, Countermine, and Demolitions for formal development. For example, the Standoff Airborne Detection ATD transitioned in FY92 to the Airborne Standoff Mine Detection System (ASTAMIDS) demonstration and validation program. The Explosive Neutralization technology demonstration transitioned in August 1994 to the Explosive Standoff Minefield Breacher demonstration and validation program. In FY95, the successful demonstration of the handheld Close-In Man-Portable Mine-Detection transitioned to the Handheld Standoff Mine Detection System (HSTAMIDS) demonstration and validation program development program. The transition of these successful technology efforts into formal development will enable to Army to put significant new capability into our operational forces.

I am joined here today by my colleague BG Beauchamp of the Army Materiel Command. We will provide additional information on the countermine program during the course of our testimony this afternoon.

Mr. WELDON. Thank you.
General Beauchamp, welcome.

STATEMENT OF BRIG. GEN. ROY E. BEAUCHAMP, DEPUTY CHIEF OF STAFF FOR RESEARCH AND DEVELOPMENT AND ENGINEERING, U.S. ARMY MATERIEL COMMAND

Mr. BEAUCHAMP. Thank you, Mr. Chairman and members of the subcommittees.

I am Brig. Gen. Roy Beauchamp, Deputy Chief of Staff for Research, Development, and Engineering at the Army Materiel Command. I also serve as the Deputy for Combat Service Support on the staff of the Assistant Secretary of the Army for Research, Development, and Acquisition, and I am here today to join with the other witnesses to discuss our countermine equipment and countermine research and development programs.

I have a brief statement, and I have provided a more extensive statement for the record.

Mr. Chairman, let me say that, first of all, it is an honor for me to appear before the committee and discuss this program which is so very important to soldiers in the field.

One of the greatest threats facing U.S. forces today at every level of conflict is the landmine. Its low cost, its availability, its effectiveness, and ease of deployment have made it one of the most widely used weapons in the world. It is, therefore, not surprising that we see its widespread use in Bosnia.

Our objective is to provide the best equipment available to accommodate the full range of countermine mission requirements. That is detection, breaching, clearing, marking, and protection.

Our forces in Bosnia have available to them all of the equipment, all of the items that have been top classified and approved for field into United States Army units. These include such items as mine detectors, battalion countermine sets with rollers and plows, mine clearing line charges, and minefield marking sets.

We have also provided our forces in Bosnia with some nonstandard equipment for countermine operations. In this regard, nonstandard means equipment that has not yet, in all cases, gone through the normal acquisition process before an item is top classified and fielded to Army units.

We have been responsive also to requests for additional equipment from the United States Army, Europe, in anticipation of the countermine operation in Bosnia. This includes additional equipment which has been top classified and fielded and other equipment which the commander felt they needed to deal with the potential countermine problem. These include items such as rollers for mounting on tanks, bolt-on Army kits for tactical vehicles, and armored wheeled vehicles to provide ballistic protection against mines.

We have provided some equipment from our research and development programs to provide an enhanced capability to our soldiers. These include a vehicle-mounted mine detection system with a metal detector, infrared systems, and remote control kits. We have also provided dogs to provide—which are specially trained in mine detection.

We are also looking at other technologies that are currently being worked in our science and technology community to determine where we could accelerate development and fielding to employ the most current technologies in Bosnia. These include diffusion of metal detection systems with ground-penetrating radar and infrared systems to give us a system of systems which will then, in turn, give us a significantly enhanced capability in—for a stand-off, hand-held detection capability for soldiers involved in up-close mine detection.

In addition, we are looking to see if there are foreign systems available which we may be able to use to deal with the countermine problem.

This countermine problem is significant in part because of the wide diversity of mines and fuses, over 2,500 different types, which we must be prepared to confront. Also, the equipment we develop must be capable of operating under near 100-percent effectiveness under a wide variety of operating conditions and environmental conditions.

Recent advances in microcircuitry, electro-optics, and information signal processing have put solutions to these problems, we think, within our reach.

Our objective is to provide state-of-the-art equipment to protect soldiers and conduct operations efficiently and effectively whether under wartime conditions or in operations other than war such as Bosnia. We have a focused, fully integrated program within our science and technology and acquisition communities in the Army to achieve that objective. We are also closely linked to the other services through the triservice programs sponsored by the defense director of research and engineering and the joint logistics commanders.

Mr. Chairman, we appreciate the support of the Congress in resourcing our efforts to develop solutions to these critical problems, and we look forward to answering your questions on these matters. And if I may summarize, sir, we are intending to learn the lessons from Somalia and our deployment in Bosnia to deal with this widely diversed threat that we face and have at the same time an aggressive development program to deal with it, that is responsive to the commander, to enable us to protect soldiers and bring them home well and in one piece.

Thank you very much, sir.

[The prepared statement of General Beauchamp follows:]

RECORD VERSION

STATEMENT BY

BG ROY E. BEAUCHAMP

DEPUTY CHIEF OF STAFF FOR RESEARCH,

DEVELOPMENT, AND ENGINEERING

U.S. ARMY MATERIEL COMMAND

BEFORE THE

MILITARY PROCUREMENT SUBCOMMITTEE

RESEARCH AND DEVELOPMENT SUBCOMMITTEE

COMMITTEE ON NATIONAL SECURITY

UNITED STATES HOUSE OF REPRESENTATIVES

ARMY COUNTERMINE SCIENCE, TECHNOLOGY, AND EQUIPMENT RESPONSE TO THE LANDMINE THREAT IN BOSNIA

24 JANUARY 1996

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ON NATIONAL SECURITY

BG Roy E. Beauchamp

BG Roy E. Beauchamp was assigned to the Army Material Command on August 21, 1995 as the Deputy Chief of Staff for Research, Development, and Engineering. He also serves as the Deputy for Combat Service Support on the Staff of the Assistant Secretary of the Army for Research, Development, and Acquisition.

BG Beauchamp entered the Army in 1965. He was commissioned through Officer Candidate School in 1967. He is a graduate of the University of Nebraska at Omaha. He earned a Master of Business Administration degree from the University of Dayton and a Master of Arts in Public Administration from Central Michigan University. He is also a graduate of the Ordnance Officer Advance Course, the Command General Staff College and the Industrial College of the Armed Forces.

BG Beauchamp is a career logistician in the United States Army. He has served in a variety of staff positions up through the Department of the Army. He has commanded at the Company, Industrial Installation, Battalion, Group, and General Officer level. Prior to assuming his current duties he served as the Commanding General, Defense Industrial Supply Center, Philadelphia, PA. He served in Vietnam and in Desert Shield/Desert Storm.

BG Beauchamp and his wife, Olivia, have one son who is a student at Shenandoah University. They reside in Clifton, VA.

INTRODUCTION

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you to discuss the U.S. Army's Countermine equipment and the Countermine research, development, and acquisition program. The Army's acquisition community is striving to provide U.S. forces with the best capability to achieve their Countermine mission in Bosnia.

One of the greatest threats facing U.S. forces in any level of conflict or other contingency operations has been and will continue to be the landmine. Its cost, availability, effectiveness, and ease of employment have made it one of the most widely used weapons in the world. It is the one consistent threat that U.S. forces are likely to encounter. It is therefore not surprising that we now see its widespread use in Bosnia.

From a technical perspective, the landmine also poses one of the most difficult challenges for the material development community. To put the challenge in proper perspective it is important to understand the complexity of the threat. There are estimated to be approximately 2,500 mine and fuze combinations in the world inventory. They range from the technically simple pressure fuze to the highly sophisticated mines which can attack a target with top and side attack munitions up to 100 meters away. All of them present a hazard to U.S. forces. Both ends of the technical spectrum of mines presents its own technical

challenge for countermine. However, it is the multiplicity of the threat, infinite variety of employment options, and varying environmental conditions that serve to make countermine one of the most difficult technical challenges facing the material development community.

There is no single solution for the detection and neutralization of landmines. It is important to note that the mine threat continues to grow in lethality and sophistication of targeting sensors. Additionally, it is important to note that it is much faster and easier to change a landmine to meet a given countermeasure than it is to develop a countermeasure.

The threat facing U.S. Forces in Bosnia today is an excellent example of the complexity of the countermine problem. While the mine threat consists primarily of simple pressure fuzed mines, they have low metallic content, which makes them difficult to detect. When combined with difficult terrain and adverse weather conditions, the overall degree of difficulty in addressing a low tech threat serves to make countermine operations extremely difficult.

We are taking advantage of the lessons we learned in Desert Shield/Desert Storm and Somalia. These two events have reaffirmed the threat posed by mines and the variety of conditions under which they can be employed with great efffectiveness. These experiences have focussed our attention on

the need for improved detection. We are looking at recently developed and developing technologies such as ground penetrating radar, infrared and electro-optic systems to deal with this threat. We have also initiated actions to give us increased ballistic and mine blast protection for our tactical wheeled vehicle systems which are critical in operations such as Bosnia.

The Army has taken an aggressive leadership role in equipping the U.S. Forces with Countermine equipment for deployment to Bosnia. In addition to supporting fielded equipment, we are working to support the Theater CINC in obtaining requested equipment to augment the fielded capability. The U.S. Army Project Manager for Mines, Countermine and Demolitions has the lead with support from Army Material Command (AMC) to obtain the equipment requested by the forces deployed to Bosnia. First priority is being given to the equipment specifically requested by USAREUR.

AMC Headquarters has established a technology integration cell that is currently serving as a clearing house for technologies with possible application for the Bosnia deployment. The AMC cell has issued a DoD wide data call and has assembled a group of subject matter experts to screen the proposed technologies. The most promising technologies are being identified and offered to the CINC for consideration for use in Bosnia.

In presenting the countermine program, we will work within the framework of the five operational imperatives for Countermine: detection, breaching, clearance, marking and protection. The order of presentation will be a discussion of the state of the art for each of the operational imperatives and challenges faced by the material development community. We will then review fielded equipment, equipment requested by USAREUR, systems in development, the science and technology base, emerging technologies and a review of systems available in the foreign marketplace.

DETECTION

Detection of land mines and minefields presents the greatest technical challenge of the five operational imperatives. Essentially, scientists and engineers from industry and Government are investigating technologies that look for buried objects made from a variety of materials including plastic, metal and wood that closely resemble many natural objects such as rocks and tree roots. The objective of the research is to discriminate the mines from this background clutter while achieving operationally acceptable speeds of advance.

The ultimate goal of the Army's mine detection program is to provide the soldier with winning edge equipment to detect both plastic and metal cased buried and surface antitank and antipersonnel mines and minefields. Near 100 percent detection

probabilities, near zero percent false alarms and militarily significant rates of advance are included in this goal.

Mine and minefield detection systems are categorized by their host platform. The platforms are air, ground vehicle and soldier. State of the art technologoies being implemented for the aerial platform include active and passive infrared line scanners and lasers. For the ground vehicle, forward looking infrared, ground penetrating radar, and pulsed induction metal detectors provide the most promise. For the soldier, the state of the art metal detector was first fielded in 1992. Additional research and development focuses on forward looking infrared and ground penetrating radar. The key to each of the platform specific technologies or technology combinations is signal processing and automated target recognition algorithms.

A score of other mine detection technologies have been evaluated during the past two decades. These technologies include nuclear, explosive vapor detection, acoustic and seismic, ground penetrating radar, and biosensors to include bacteria and animals. Although some of these technologies are not adequate for the Army's countermine mission they have shown application for demining and UXO disposal missions where operation time and tempo of execution can be selected during optimal weather conditions. With advances in computer processing, some of the previously rejected potential technologies are being re-examained.

BREACHING

Breaching systems available to U.S. Forces fall into three categories: explosives, mechanical and electronic. As newer and more sophisticated mines are developed and fielded, more robust countermeasures are needed. Both vehicle and man portable systems exist.

a. Explosives: Vehicle mounted and man portable systems exist which use rocket launced explosive line charges to create a path through a minefield. Man portable systems have been evaluated for use by dismounted troops to breach a footpath lane through an antipersonnel minefield. No man portable systems have been fielded for use by U.S. Forces, however such a system is in development.

b. Mechanical: Most typical mechanical systems are mine plows, rakes, flails and rollers for heavy armored vehicles. While these mechanical systems can be developed for virtually all military vehicles, only those for heavy armor have been fielded to U.S. forces.

c. Electronic: There are a number of electronic devices designed to activate magnetic influence fuzed mines before the vehicle passes over them. The U.S. Army developed and type classified the Vehicle Magnetic Signature Duplicator

(VEMASID) but it was never produced due to cost of outfitting the number of vehicles identified as host platforms. The only one currently available to U.S. Forces is the USMC Field-expedient Countermine System (FCS). Both systems function by projecting a magnetic field in front of the vehicle which spoofs the mine into prematurely actuating. Several countries have manufactured similar systems.

CLEARANCE

A distinction needs to be made between breaching and clearance systems. Breaching systems are designed to rapidly create a breach through a minefield under combat conditions to prevent losses due to attrition by hostile fire covering the mined area. Clearance systems on the other hand are optimized for durability and survivability while clearing as close to one hundred percent of the mines as possible in a given path. Some systems can potentially serve both purposes but with a loss in overall effectiveness. The U.S. currently does not possess any mechanized clearance capability outside of armored bulldozers and a prototype mini flail for clearing antipersonnel mines. This is a remote control diesel powered flail system on a small skid loader chassis. The flail is a high speed rotating drum with chains attached designed to beat the ground and initiate simple pressure fuzed mines and trip wire mines in a one meter wide path. The mini flail is not fully effective against all antipersonnel mines in that some threat mines have been hardened

to require sustained pressure to initiate them. Clearance for military missions is accomplished through the use of hand held mine detectors, mine probes and explosives to blow the mines in place, if the mines are not removed by hand.

MARKING

Marking systems can be divided into two separate categories, hand emplaced and mechanized systems.

a. Hand emplaced: Hand emplaced marking capabilities run the gamut from manufactured articles to improvised items, such as tape and stakes.

b. Mechanized Marking Systems: These systems are typically used in combat breaching operations. They consist of markers dispensed from the back of a breaching vehicle which mark the center or sides of the breached path. The Cleared Lane Marking System used by U.S. Forces in Southwest Asia is no longer fielded due its ineffectiveness in Operation Desert Storm. No replacement system has been selected to date.

PROTECTION

Blast and fragmentation protection for wheeled vehicles has been largely ignored since Vietnam. We have applied the lessons learned in Somalia in developing solutions to provide increased

protection for our soldiers. Requirements by light forces with wheeled vehicles in Somalia, resulted in bolt-on mine blast and ballistic protection kits for HMMWVs and 5 Ton Trucks.

Armor upgrades to existing wheeled vehicle platforms are limited in the amount of protection provided. A wheeled vehicle encounter with an anti-tank mine will normally result in catastrophic destruction of the vehicle, and dramatically increases the risk of personnel casualties if the mine contains more than 12 lbs of explosive.

FIELDED EQUIPMENT

The following equipment is currently fielded for use by U.S. forces:

DETECTION EQUIPMENT

AN/PSS-12 MINE DETECTOR/BONNETS/PROBES

The current fielded mine detector is known as the AN/PSS-12. It is a state of the art metal detector which uses pulse induction metal detection technology. It is capable of detecting metal mines and mines with metal content, possibly as low as 0.2 grams of metal depending on the depth of burial of the mine, access to the mine (snow cover, foliage) and composition of the metal. To our knowledge, all of the mines found in Bosnia are

detectable by the PSS-12. Overpacked with the detectors fielded to early deploying units are two plastic mine probes and ten mine marking bonnets. These items also have assigned National Stock Numbers and are available in the supply system. The AN/PSS-12 which also bears the NATO designation of AN/19-2 is fielded with a number of our allies to include the Canadians and Germans. It was also the detector of choice used by commercial organizations involved in the cleanup of the U.S. sector of Kuwait.

BREACHING EQUIPMENT

BATTALION COUNTERMINE SET FOR M1 TANK (ROLLERS AND BLADES OR TRACK WIDTH MINE PLOWS)

The U.S. Army currently has a mine plow and a roller capability for the M1 tank. The mine plows or blades create a breach by excavating mines in front of the tracks. The rollers detonate pressure fuzed mines in front of the tracks and can withstand several mine blasts. The plows and the rollers are equipped with dogbone assemblies on chains stretched between the plows and rollers to protect the belly of the tank against tilt rod mines. Also available are magnetic dogbones which protect the belly of the tank against magnetic influence fuzed mines.

MINE CLEARING RAKE

The Mine Clearing Rake was developed for use in Desert Storm on the M728 Combat Engineer Vehicle. It was designed for use in sandy soils and does not have high utility in Bosnia. The structure and tines are not designed for the heavier stresses on the tines that would be caused by clay and loamy soils.

MICLIC/AVLM

The currently fielded heavy force explosive breaching system is the Mine Clearing Line Charge (MICLIC). This system consists of a rocket propelled line charge that is intended to create 5 meter wide by 100 meter long breach through a minefield. The system can be mounted on a trailer or on top of the Armored Vehicle Launched Bridge chassis when the bridge is removed.

MARKING EQUIPMENT

HEMMS/MINEFIELD MARKING SET #2

The Hand Emplaced Minefield Marking Set (HEMMS) is used as a temporary means to mark the perimeter of a minefield and to mark a cleared lane through the minefield. Each set consists of directional flashing lights, mine signs, fluorescent orange tape, poles and a pole driver and is capable of marking up to 700-1000 meters. The perimeter formed by these components yields a highly visible fence around or through the mined area. If the marking is required to be in use for more than 15 days, the HEMMS should

be replaced with Minefield Marking Set #2 which consists of posts, fence wire, signs and lights.

CLEARANCE EQUIPMENT

MINE CLEARING ARMOR PROTECTION KITS (MCAP) FOR D-7 DOZERS

This is an armor kit for a D-7 dozer which allows the use of the bulldozer for mine clearance applications. The dozer can be equipped with a modified version of the mine clearing rake. The rakes will not be used in Bosnia for the reasons stated earlier.

PROTECTION

UP-ARMORED HMMWV

108 Up-Armored HMMWVs, built by AM General, have been delivered to Europe.

BODY ARMOR SET, INDIVIDUAL COUNTERMINE (BASIC)

A Kevlar protective suit consisting of Anti-Fragmentation Trousers, Ballistic Eye Protection, and Antipersonnel Mine Protective Overboots. The system is designed to minimize blast and fragmentation injuries to soldiers conducting countermine operations.

FIELDED NON STANDARD ITEMS

DETECTION EQUIPMENT

VEHICLE MOUNTED MINE DETECTOR

A prototype system using a commercially available metal detector, two infrared cameras mounted and a paint marking capability on a remote controlled 5 ton truck was provided to the 16th Engineer Battalion in Bosnia for evaluation.

DOGS

Two mine sniffing dogs have been provided for use by the troops in Bosnia. These dogs were diverted from an ongoing research and development program.

BREACHING EQUIPMENT

FIELD-EXPEDIENT COUNTERMINE SYSTEMS (FCS)

The Field-expedient Countermine System (FCS) is a Marine Corps system which consists of an electronic amplifier and a large coil mounted on the front of an armored vehicle. The coil can be wound in the field and armor protection for the coils is available. The system projects a magnetic field which is intended to initiate magnetic influence fuzed mines before the

vehicle passes over them. This system is in the hands of soldiers in Bosnia.

CLEARANCE EQUIPMENT

MINI FLAILS

Two prototype mini flails for clearing antipersonnel mines have been fielded for use by U.S. forces in Bosnia. At this time they are the only two in existence. Two additional mini flails are being fabricated by the U.S. Navy Office of Special Technology.

PROTECTION EQUIPMENT

ARMOR KITS FOR HMMWV

The HMMWV Armor Kit is a retrofittable kit that includes front and rear exterior blast deflectors, interior floor pans for all four positions, armored front and rear seats, tail gate, doors for all positions, and ballistic windshields. The complete kit provides small arms, mine blast and fragment protection and weighs 950 pounds.

ARMOR KITS FOR 5 TON TRUCKS

The 5-Ton Armor Kit consists of external blast deflectors, cab (floor) fragment protection and energy-absorbing seats with four-point personnel restraints. The light kit provides protection from pressure fuzed mines detonated under the front wheels, while the heavy kit includes a centerline blast deflector to protect the crew from command detonated mines detonated under the center of the vehicle.

ITEMS REQUESTED BY USAREUR

The following equipment has been requested by USAREUR in anticipation of the Countermine mission in Bosnia:

BREACHING EQUIPMENT

M1 ROLLERS

An additional quantity of 32 units was initially requested to augment the 12 systems on hand. The requirement has been reduced to 20 systems. 13 units have been delivered to date. The remaining 7 will come from FORSCOM stocks.

M1 ROLLER MOUNTING KITS

These kits are required to mount the mine rollers to the M1 Tank. A quantity of 20 was requested to augment the 12 systems on hand. All mounting kits have been delivered to Germany.

M60 ROLLERS

USAREUR requested 12 Rollers for M60 tanks. These are of a slightly different configuration than the rollers for the M1 tank and can be mounted directly to the M60 tank without a mounting kit. The M60 Rollers will be mounted on remote controlled M60 tanks chassis. They will be used to proof potentially mined areas without exposing the operators to danger from exploding mines. 9 units have been delivered to Germany. 3 Rollers are in transit to Germany.

ANTI MAGNETIC MINE ACTUATING DEVICES (AMMAD)

These are magnetic dogbones which protect the belly of the tank against magnetic influence fuzed mines when used with a mine plow or roller. Dogbones are devices which are suspended between the rollers and between the plows on the Battalion Countermine Sets to activate tilt rod mines. A quantity of 20 was requested. These items were obtained on loan from the Marine Corps and are in transit to Bosnia.

LAUNCHED GRAPNEL HOOK

For dismounted troops, a bullet trap Launched Grapnel Hook (LGH) has been tested and has been accepted for service use. This device can be used to initiated trip wire mines from a

position of concealment. A limited quantity (180) of these devices has been delivered to USAREUR for fielding.

FIELD-EXPEDIENT COUNTERMINE SYSTEMS (FCS)

A quantity of 16 was requested to augment the 4 systems already fielded. These systems have been shipped to Fort Belvoir for retrofit before shipment to Bosnia.

CLEARANCE EQUIPMENT

MINE CLEARING ARMOR PROTECTION KITS (MCAP) FOR D-7 DOZERS

17 kits were requested to augment the 5 on hand. 11 systems are now on hand in Germany and an additional 11 are to be delivered from the end of January through June from the contractor.

PROTECTION EQUIPMENT

UP-ARMORED HMMWV

250 Up-Armored HMMWVs have been requested by USAREUR. An existing HMMWV production contract has been modified by the Army to ramp up the production of the Up-Armored HMMWVs for quick delivery to Bosnia beginning in late January 1996.

ARMOR KITS FOR HMMWV

180 kits were requested. Funding has been released for the fabrication of 113 kits with deliveries to start in March at a rate of 30 systems per month.

ARMOR KITS FOR 5 TON TRUCKS

165 kits were requested. Funding has been released for 150 kits to be built at Rock Island Arsenal with delivery of the first 15 by the end of February. Subsequent deliveries of 30 units per month will follow.

BODY ARMOR SET, INDIVIDUAL COUNTERMINE (BASIC)

180 sets were requested and delivered prior to 25 December 1995.

DEVELOPMENT PROGRAMS

The following is a discussion of development programs being pursued by the Army today:

DETECTION

a. Airborne Detection: The U.S. Army is currently developing the Airborne Standoff Minefield Detection System

(ASTAMIDS). The objective of the ASTAMIDS program is a system to be deployed on a UAV platform that will enable U.S. forces to detect threat minefields from a standoff position and influence plans to breach or bypass the minefields. It will use passive IR sensors and possibly active laser sensors to detect mines and minefields from the air. The development program is at a critical juncture in that the contractors are taking delivery of hardware and integrating subsystems. The effort is fully funded. Presently there are a number of hardware integration issues to be resolved. At the conclusion of testing in the summer of 1996, should either of the two candidate systems show promise, consideration will be given to sending a system to Bosnia for further evaluation.

b. Vehicle Mounted Detection:

The current ongoing program is a Foreign Comparative Test (FCT) program called Interim Vehicle Mounted Mine Detector (IVMMD) program. The intent of the IVMMD program is to field an interim capability based on metal detection technology comparable to the current hand held detector in the field. The FCT program is a two phased effort to evaluate two foreign systems, one South African and one Austrian/UK combination which use blast hardened vehicles and state of the art metal detectors. The first phase of the program to evaluate the metal detectors has been completed with a slight edge going to the Austrian metal detector. Funding for phase II in FY 96 has just been released to the contracting

officer. In phase II, evaluation of the vehicle platforms will be completed. For the purposes of operations in Bosnia, acceleration of the effort is being considered. The French and Germans have both recently initiated procurement of the South African system which also includes a complementary system of trailers that are used to proof the swept area by detonating any missed mines. The system is also in service with South African forces.

c. Hand-held Detection:

A field evaluation of advanced hand held detectors was conducted in the summer of 1995 under the Close In Man-portable Mine Detection ATD. In the demonstration, one IR and three GPR systems were evaluated with a strong emphasis on detection of non metallic mines. While the results were promising enough to initiate a formal development program under the name HSTAMIDS (Handheld Standoff Mine Detection System), the prototypes demonstrated are not sufficiently mature for fielding to Bosnia. The ATD was successful in demonstrating the capability of GPR devices to detect nonmetallic mines however a significant amount of optimization needs to be done to improve the probability of detection for small plastic antipersonnel mines. The system is not yet ready for fielding.

BREACHING

The Anti-Personnel Obstacle Breaching System (APOBS) is in development by the Marine Corps and the Army. This a man portable system for use by dismounted troops that breaches a path through the minefield and cuts any barbed wire in the path. A fully functional and safety approve fuzed is the one final hurdle to finishing the development. There is a two year lead time required for startup of production after the system is approved for service use.

The Explosive Standoff Minefield Breacher is a current U.S. Army and Marine Corps development program designed to replace the MICLIC system. It is in the early stages of development and is not sufficiently mature to warrant acceleration for use in Bosnia.

The M1 Breacher is a current development program to provide the Combat Engineers with an in-stride breaching capability that can keep up with the maneuver force. The system is comprised of a full width mine plow and a telescopic excavating arm on an M1 tank chassis. The system is design to have the same survivablity as the M1 tank. An LRIP production decision is scheduled for FY98.

CLEARANCE

There are no current funded development efforts for Clearance equipment.

MARKING

There are no current funded development efforts for Mine/Minefield Marking.

PROTECTION

There are no current funded development efforts for Protection equipment.

SCIENCE AND TECHNOLOGY PROGRAM

These programs focus on finding and developing new science and technology solutions to critical user needs. Advanced Technology Demonstrations (ATD) are major technology demonstration programs that are approved at the Department of Army level. Advanced Concept Technology Demonstrations are generally "systems of systems" that may incorporate multiple ATDs and are approved by the Office of the Under Secretary of Defense for Advanced Technology. The ACTD develop new concepts of operations by placing residual systems in the hands of the CINCs for evaluation and potential use in wartime.

JOINT PROGRAMS

At the forefront of the Army's Countermine Science and Technology program is the Joint Countermine Advanced Concept Technology Demonstration (ACTD). The vision for the Joint Countermine ACTD is to demonstrate the seamless transition of countermine capabilities from sea to land operations in the face of serious mine warfare threats, i.e., sea mines, littoral mines and land mines. The Joint Countermine ACTD combines fielded systems, those in advanced development, and science and technology items with command and control advances and robust modeling and simulation activities to demonstrate a countermine system of system solution to the mine problems facing a joint commander. It represents the culmination of near term Army technology developments and provides a basis for demonstrating new capabilities in an operational environment. The Army technologies plus selected Navy and USMC technologies are being provided to the Commander in Chief, U.S. Atlantic Command, for use in designated 1997-98 fleet exercises. In total, twelve novel countermine systems will be demonstrated, four of which are Army. The novel Army countermine systems include Airborne Standoff Minefield Detection System (ASTAMIDS) to remotely detect enemy minefields, Close In Man-portable Mine Detector (CIMMD) to detect both metallic and plastic mines, and the Off Route Smart Mine Clearance System (ORSMC) to clear top and side attack mines. The basis for the countermine technologies in the Joint Countermine ACTD are completed and ongoing Advanced Technology Demonstrations for both mine detection and mine neutralization systems.

DETECTION

Vehicle mounted Mine Detector Advanced Technology Demonstration

This vehicle mounted Detection System will fuse pulse induction metal detector with down looking ground penetrating radar and forward looking infrared cameras. This combination of sensors will provide reliable detection probabilities at acceptable rates of advance. The field demonstration of this technology is scheduled for the latter part of FY 97.

BREACHING

Off Route Smart Mine Clearance Advanced Technology Demonstration

The Off Route Smart Mine Clearance System employs multispectral signature reproduction technologies (acoustic and seismic), advanced threat signal processing emulations, low observable technologies and teleoperation to clear routes of smart side and emerging top attack mines. The use of teleoperation provides operator survivability. The platform for the advanced technology demonstration is a HMMWV which provides a low cost, easily transportable solution.

CLEARANCE

No efforts are currently underway that specifically address mine clearance in military operations. However, in fiscal year 1995, the Army executed a congressional special interest program in humanitarian demining in support of ASD(SO/LIC) to demonstrate technologies, techniques and equipment that make demining operations safer, more cost effective and less manpower and training intensive. The Department intends to leverage the most promising of these efforts for military clearance activities. Mr. Reingruber OASD(SO/LIC), will address humanitarian demining efforts.

PROTECTION

In addition to the work described previously to protect HMMWV's and 5-ton trucks, efforts are underway to leverage those designs for application to the 10-ton Heavy Expanded Mobility Tactical Truck (HEMTT). The goal is to provide sufficient vehicle protection for crew survivability while not substantially hindering vehicle performance or capacity.

EMERGING TECHNOLOGIES

DETECTION

Emerging technologies under study for mine detection have the potential to decrease false alarms and to increase detection standoff distances. Technologies include hyperspectral and multispectral sensors, vehicle mounted forward looking radar and artificial biosensors for detection of explosives. A supporting technology is neural networks which offer the potential to truly integrate sensors for high detection probabilities and to provide ultra high speed signal processing across multiple environments. Other agency work in autonomous platforms is being studied for application to the mine detection challenge.

BREACHING

An emerging concept for leap ahead breaching is the Mine Hunter Killer. A technology demonstrator will integrate forward looking standoff detection devices (electro-optic and radar) with point or small area neutralization devices (explosives, kinetic energy or directed energy) to provide an efficient in-stride breaching capability. Other emerging breaching technologies include electron beam and radio frequency projection, light weight lasers, chemical neutralization of explosive compounds, as well as kinetic energy and area explosives.

FOREIGN SYSTEMS

DETECTION

To our knowledge, there are no foreign systems in production or in the field that are suitable for the airborne mine detection requirement. Discussion of foreign vehicle mounted mine detectors can be found in the discussion of developmental systems. There are a considerable number of hand held metallic mine detectors available from foreign sources. Some of these were evaluated during the source selection for the current fielded system, the AN/PSS-12, which is manufactured in Austria.

BREACHING

The German Keiler and Israeli Miki flail systems have been designed for combat breaching purposes. Contractors in Israel and the UK have developed systems for Armored Personnel Carriers and Bradley Fighting Vehicles. These consist of surface mine plows and lightweight rollers. The UK has a limited quantity of surface mine plows in service. The U.S. Air Force is evalauting variants of these surface mine plows for runway clearance.

A number of countries have explosive breaching systems similar to the U.S. MICLIC system. There are also several man portable explosive breaching systems available from foreign sources. Several of these have been evaluated under the U.S. Army's Soldier Enhancement Program.

CLEARANCE

There has been some development of equipment in recent years that may be suitable for area clearance by a number of nations. These are typically flails and land clearance machinery which mill away the soil and the buried mines. For flails, most noteworthy are the German Keiler, British Aardvark and the Israeli Miki. The German and Israeli systems have been designed for breaching purposes and have not been thoroughly evaluated for clearance operations. Germany has entered into production of the Keiler and Israel is still developing the Miki. Sweden and Norway are both pursuing development of land clearance devices for mine clearance. These machines are based on armored platforms with large rotating devices out front with hardened steel cutters that chew up the soil, vegetation, including small trees, and any mines in the path. These systems have not been fully evaluated in a mine clearing role. There is also a German land clearing device that is to be evaluated in Germany by USAREUR which is similar to Norwegian and Swedish systems. The risk with all of these systems in a clearance role is that they disturb a great deal of soil and can create a bigger problem by displacing mines and creating a hazardous situation where the safety of handling the disturbed mines is unknown. There are currently no U.S. Army requirements for such systems.

MARKING

For vehicle mounted marking systems, the most likely candidate for consideration is the British developed Pathfinder

system which uses compressed air to fire markers into the soil on either side of the breaching vehicle. Pathfinder has been subjected to limited evaluations by both the Marine Corps and the Army.

PROTECTION

The Republic of South Africa has developed the latest state-of-the-art mine resistance vehicles capable of withstanding mine blasts from 25-45 lbs. of explosive. These vehicles also possess all around ballistic protection and are designed to be repaired after a mine encounter. A British firm has licensing rights for two types of mine resistant vehicles.

CONCLUSION

The countermine challenge is significant from a technology standpoint. It is not significant because of mine technology, though the technology is becoming increasingly sophisticated. It is significant because mines are cheap, portable, easily emplaced and with over 2,500 different types of mines and fuzes presents a wide diversity of problems to solve. Further, it is much easier, faster and cheaper to modify mines to counter state-of-the-art detection systems than it is to develop or adapt detection systems because of the need to achieve a near 100% effectiveness rate. The problem is also complicated by the requirement for U.S. Forces to be able to effectively operate in a wide variety

of scenarios ranging from deserts to forests and jungles to built-up urban areas. Ideally, we need systems to detect, clear, breach, mark and protect in all of these operating environments. Resourcing these efforts is critical and additional resources could enable us to develop solutions and field equipment more quickly. But we realize that funds are limited and funds available must be accommodated within the overall priorities for the department. Also, we now have technologies and potential technological solutions that have only recently shown promise which will contribute to the solution of these daunting problems. Examples include advances in micro-circuitry, electro-optics, and information processing.

Our primary objective is to provide a state-of-the-art capability to reduce the number of soldiers killed in combat and operations other than war. We are developing technologies that are cost effective, sustainable, which will operate in a wide variety of scenarios and environmental conditions and which will defeat the problem we have to face of minor changes in mine technology requiring major changes in detection technology. We believe the solutions we are pursuing with ground penetrating radar, pulse induction metal detection, infrared and electro-optic technology will achieve these objectives. Further, the efforts we are making to fuse these technologies provides the potential for orders of magnitude improvements in effectiveness and reliability.

Within the Army, we have a fully integrated program that is taking advantage of technologies and support from a variety of sources. This integrated approach, in the science and technology community and in the acquisition community, is facilitating the accelerated development and fielding of improved, more effective equipment.

We are working closely with the other services to develop systems which have joint application. We have a highly focused mine/countermine program in the Army to achieve that end and we are active participants in the Tri-Service programs sponsored by DDRE and the Joint Logistics Commanders.

We also recognize the need to look at and capitalize on, technologies and capabilities developed by other nations. We are doing that where those technologies show the potential to reduce the time and cost to put an improved capability in the hands of soldiers.

I believe our experience, doctrine and testing have shown that mine/countermine operations require not a single capability, but a suite of capabilities to effectively meet operational requirements for detection, breaching, clearing, marking, and protecting. The Army has chosen to place its emphasis for our limited R & D funding, on mine detection and neutralization. Mine detection is the most difficult problem but emerging technologies have put us on the verge of solutions to these

problems even though the threat continues to grow in sophistication and lethality. Our goal is to make this technology work for soldiers: to enable us to send soldiers to operational areas like Bosnia with the assurance to them and their families and the American people that we are making every reasonable effort to see that they come home alive and well. We also feel strongly that the work we are doing will contribute to the solution to the problem of indiscriminate use of mines around the world which has placed innocents at risk. The continued support of the Congress is vital to our efforts and we appreciate the opportunity to tell you what we are doing to provide the best capability to U.S. Forces to defend against this system.

Thank you very much for the opportunity to present information on these important issues. We look forward to answering your questions.

Mr. WELDON. Thank you, General Beauchamp.

I think a little out of sequence, our next witness is Dr. Manley, if I am not mistaken. Dr. Manley.

STATEMENT OF CLAUDE MANLEY, DEPUTY DIRECTOR, NAVY JOINT EXPLOSIVES ORDNANCE TECHNOLOGY DIVISION, U.S. NAVY SURFACE WARFARE CENTER, INDIAN HEAD DIVISION

Mr. MANLEY. Thank you. Thank you very much for the opportunity to speak.

Good afternoon. I am Claude Manley, the technical director at the Navy-managed joint service activity, responsible for providing military bomb disposal technicians with equipment and information used in the emergency neutralization of hazardous devices. We are part of the Naval Ordnance Center.

The traditional role of all military explosives ordnance disposal [EOD] is to find and neutralize dud or damaged explosive-loaded munitions which are a hazard to operations and require a one-on-one response by highly trained and experienced technical specialists. EOD also deals with terrorists' improvised devices, explosive, chemical, radiological, and nuclear.

Explosives ordnance disposal [EOD] technicians are not normally used to breach land mine fields during an assault. Their numbers are too small, and they are not trained and equipped to operate in contact with enemy forces.

EOD technicians are routinely involved in the neutralization of ordnance and mines left behind by combatant forces. In the context of modern ordnance, the distinction between mines and improved conventional munitions is disappearing, and the tradition of EOD is expanding to include wide area ordnance decontamination.

The activities of the Naval EOD Technology Division support the EOD's specific joint service requirements, part of which addressed ordnance detection. As part of our continuous assessment of useful technologies, we manage an environmental unexploded ordnance remediation program for the Army Environmental Center. This program funds companies to demonstrate technologies applicable to locating and recovering ordnance on military firing ranges, both active and passive. We are also providing technical services on site to support the contracting by the Navy for the cleanup of Koha'olawe Island.

The detection of anomalous objects is a difficult problem, difficult technical problem. In World War II, mines were made of metal, and this feature was exploited by developers of mine detection equipment. Low-signature mines, handcrafted shoe-box mines, were first used against United States forces during the Korean conflict. In 50 years, improvements in manufacturing technology have made possible the high-volume, low-cost production of low-signature mines. Although of limited usefulness now, metal detectors will have an almost nonexistent mine countermeasures utility in the near future.

Naval Explosives Ordnance Disposal Technology Division [NAVEODTECHDIV] develops and purchases ordnance locators for use on land and in the ocean. Since the majority of ordnance is metal cased or contains significant quantities of metal, our development focus has been on magnetometry, passive detection of ferrous

materials, and low-frequency electromagnetic induction, active detection of conducting materials. At present, EOD uses operationally two passive and one active hand-held locator.

The Naval Explosive Ordnance Disposal Technology Division has in development, for a number of customers, the following projects with some long-term applicability to the mine countermeasures problem, probably of limited usefulness to the media problem in Bosnia, and I will summarize quickly what these programs are.

We have about three very sensitive metal locators in development. We also have four autonomous vehicle programs in development. One of these autonomous vehicles is a somewhat innovative concept. It uses very small robots. The idea was pioneered at the Massachusetts Institute of Technology. We call the program BUGS. These are very small, very light-weight devices. You turn a lot of them loose and tell them to go find mines.

That concludes my statement.

Mr. WELDON. Thank you, Dr. Manley.

Mr. Reingruber.

STATEMENT OF JOHN REINGRUBER, ASSISTANT FOR SCIENCE AND TECHNOLOGY, OFFICE OF THE ASSISTANT SECRETARY FOR SPECIAL OPERATIONS/LOW INTENSITY CONFLICT, DEPARTMENT OF DEFENSE

Mr. REINGRUBER. Mr. Chairman, members of the committee, thank you for the opportunity to discuss capabilities recently developed in the Humanitarian Demining Research and Development Program. I also will discuss contributions from another program under the oversight of Assistant Secretary of Defense (special operations/low intensity conflict) [ASD (SO/LIC)].

I am John Reingruber, assistant for science and technology in the Assistant Secretary of Defense for Special Operations Low-Intensity Conflict Office in Office of the Secretary of Defense [OSD].

Although the EOD established the humanitarian demining R&D program to develop equipment specifically for humanitarian demining purposes, some of these items may well assist and can be made available to the troops in Bosnia. They include a vehicle-mounted detection system for on-road and off-road mine detection, a system to remotely collect vapor samples that are subsequently transported to dogs for detection of explosives, an explosive foam called otherwise known as liquid explosive foam [LEXFOAM] to destroy mines in place.

In addition to these items, we also can make available a hardening foam that prevents activation of mine fuses and marks individual mine locations, special shaped charges to neutralize mines, and a mine-marking device that attaches to any open-ring, hand-held mine detector.

As a result of the R&D conducted in this program, six mine-detecting leash dogs and handlers are scheduled to be deployed to Bosnia next week. As we move ahead with this fast-track program through fiscal year 2001, we will continue to identify systems applicable to countermine operations.

The explosive ordnance disposal in a low-intensity conflict program, although not specifically for countermine development, has made the following equipment available for Bosnia: The mini-flail,

which is capable of neutralizing antipersonnel land mines and improvised explosive devices while sustaining mine blast effects. One of the two flails is currently in Bosnia and the other awaiting transport to Europe.

Two improve mini-flails developed by the Humanitarian Demining R&D Program will be made available in the next 2 months.

A titanium mine detection probe that has been developed and—over 60 have been deployed to Bosnia with the U.S. Special Forces.

A mine data base developed for the Special Forces has been enhanced. The mine facts data base that Congressman Evans showed has 500 copies in floppy disk format that will be delivered for use in Bosnia next month.

Another project that may have applicability is the Special Operation Forces Vehicle Ballistic Protection System. This is an improved lightweight system for use on their vehicles to protect against blast and fragments delivered by 12-pound antitank mines. If tests are successful, kits could be made available as early as March of this year.

As we continue to seek solutions in the next 5 years, we will be evaluating and advancing technologies that hold promise. Examples are ground-penetrating radar, infrared censors, robotics, and semiautonomous systems, and chemical neutralization techniques.

That concludes my oral testimony. I will be followed by Dr. Michael Dow from the National Academy of Sciences.

[The prepared statement of Mr. Reingruber follows:]

STATEMENT BY

JOHN K. REINGRUBER

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

(SPECIAL OPERATIONS AND LOW-INTENSITY CONFLICT)

BEFORE THE

RESEARCH AND DEVELOPMENT SUBCOMMITTEE

AND

THE PROCUREMENT SUBCOMMITTEE

OF THE COMMITTEE ON NATIONAL SECURITY

UNITED STATES HOUSE OF REPRESENTATIVES

104TH CONGRESS

RESPONSE TO THE LANDMINE THREAT IN BOSNIA

JANUARY 24, 1996

NOT FOR PUBLICATION UNTIL

RELEASED BY THE HOUSE OF REPRESENTATIVES

NATIONAL SECURITY COMMITTEE

January 22, 1996

Mr. Chairman, members of the Committee, thank you for the opportunity to discuss demining technology recently developed and under development in the Humanitarian Research and Development (R&D) Program as well as other efforts in the Department of Defense not specifically under the Army's Tactical Countermine Program or the Unexploded Ordnance (UXO) Advanced Technology Demonstration Program.

Although the DoD established the Humanitarian Demining R&D Program to develop equipment and systems specifically for humanitarian demining purposes, some of these items may well assist and can be made available to the troops in Bosnia. The Army's Communications and Electronics Command's Night Vision and Electronic Sensors Directorate developed and demonstrated over 30 prototype items for humanitarian demining in FY 1995. At the direction of the Office of the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict [ASD(SO/LIC)], the program manager has provided to Army planners in the U.S. and Europe a list of items from the program that could augment current countermine capabilities.

The Humanitarian Demining R&D Program applies available technologies to develop equipment for humanitarian demining and Military Operations Other than War. The program benefits by using technical inputs from: the Tactical Countermine Program and the UXO Advanced Technology Demonstration Program; the United Nations and a number of cooperating countries; and regular consultations with other government agencies, private industry, and operational representatives from the military and non-government organizations. Furthermore, coordination with representatives from the regional commanders indicated an immediate need for short-term, low-technology solutions to the humanitarian demining problem.

This program has emphasized the development of low-risk equipment to improve the efficiency and safety of humanitarian demining operations. Projects were developed that leveraged the technology previous and ongoing countermine programs. The program has focused on determining reliably whether certain land areas are mined or mine-free. As part of this program, the following items were identified to the Army as being available for deployment:

- A Vehicle-Mounted Detection System for on-road and off-route mine detection. This system consists of metal detectors and infrared, ultraviolet, and visible cameras mounted on a remotely-controlled vehicle.

- An explosive foam called LEXFOAM to destroy mines in place.

- A hardening foam that prevents activation of pressure and tension-release mine fuzes and marks individual mine locations.

- Shaped charges that use shock tube initiation and small amounts of explosives.

- A mobile training system that uses multimedia equipment to produce pamphlets, tapes, posters, and imprinted T-shirts to provide mine awareness training to people of the host nation.

- A mine-marking device that attaches to any open-ring handheld mine detector.

• A Command Communications Video and Light System that consists of a mini-camera which can be mounted onto a helmet or mast with wireless audio and visual links to a remote command post. This system, which allows search without entry into a minefield, provides real-time feedback of what the operator sees from eye level or what can be viewed from a 12-foot high mast.

• Six mine detecting dogs and handlers have successfully completed basic mine detection training and are in theater. Current plans call for this capability to be deployed to Bosnia next week as an Army Military Police asset.

• A system to remotely collect vapor samples that are subsequently transported to dogs for detection of explosives. The system, which was developed based on a South African system, consists of three alert dogs, two search dogs, a collection vehicle, a collector back pack, and helicopter-deployable collector boxes. The complete system can deploy after eight to twelve weeks of handler training.

Our current plans call for continuing this fast-track development of humanitarian demining equipment through FY 2001. We will continue to identify systems applicable to countermine operations.

The Explosive Ordnance Disposal in a Low-Intensity Conflict Program, hereafter referred to as EOD/LIC, is another program under the direction of ASD(SO/LIC) developing equipment that can be made available for Bosnia. Program management is provided by the Navy's Office of Special Technology at Fort Washington, MD. Using a rapid prototype approach, the EOD/LIC program demonstrates and develops EOD technology and equipment to support low-intensity conflict and conventional EOD missions. This program has already made or will soon make the following equipment available for Bosnia:

• The mini-flail, which consists of a 36-inch wide, remotely-controlled, self-propelled flail capable of neutralizing antipersonnel land mines and other improvised explosive devices without sustaining significant equipment damage. One of the two flails is currently in Bosnia and the other awaiting transport to Europe. Two improved mini-flails developed by the Humanitarian Demining R&D Program will be made available in the next two months. These improved vehicles can sustain blast pressures from the larger antipersonnel mines.

• A titanium mine detection probe has been developed and over 60 have been deployed to Bosnia with U.S. Special Forces.

• A mine data base developed for the Special Forces that has been enhanced for use in Bosnia. Five-hundred copies of the data base, which is designed to facilitate the training of soldiers and civilians in mine recognition, will be delivered for use in Bosnia next month.

Other active EOD/LIC projects that may have applicability to missions similar to those now being performed in Bosnia are:

• The Special Operations Forces Vehicle Ballistic Protection Project. This is an improved, lightweight system for use on Special Operations Forces land vehicles to protect

against explosive fragmentation and projectiles delivered by 12-pound explosive antitank mines. Two improved steel and composite HMMWV kit designs are scheduled for explosive testing this month. If these tests are successful, kits could be made available by March 1996.

• The Automated Ferrous Locator Project. This is a small, advanced, man-portable ferrous ordnance locator for the detection of unexploded ordnance. This project is scheduled for completion in March 1996.

Emerging technologies that hold promise for future Bosnia-type missions are ground penetrating radar, infrared sensors, robotics and semiautonomous systems, and chemical neutralization techniques. We estimate that in five years or less, radars using improved signal and data processing techniques should be able to detect small antipersonnel mines with a very high level of reliability. Ongoing projects, such as the Imaging Ordnance Locator Project in the EOD/LIC program, are attempting to solve some of the challenges associated with ground penetrating radar technology.

In the next few years, operations should become safer through robotics and semiautonomous systems that will provide for remote detection and removal of mines. Additionally, chemical neutralization techniques should provide a means of entering mine casings and destroying explosive components without detonation. Within five years, the sensitivity of passive and active infrared sensors will mature. These sensors, combined with improved signal and data processing, will be used in airborne, land vehicle mounted, and handheld systems designed to identify minefields and even to detect individual mines.

Mr. WELDON. Thank you, Mr. Reingruber.
Dr. Dow.

STATEMENT OF MICHAEL McD. DOW, ACTING DIRECTOR, BOARD ON SCIENCE AND TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT, NATIONAL RESEARCH COUNCIL

Mr. DOW. Thank you, Mr. Chairman, members of the committee. I very much appreciate the invitation to describe our activities with you.

My name is Mike Dow. I am the Acting Director of the Board on Science and Technology for International Development in the Office of International Affairs of the NRC. We are a private organization. The NRC is the operating arm of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, and was chartered by Congress in 1863 to advise the Government on science and technology matters.

We have been for a number of years looking at the problem of land mines, which came to our attention when we were working with the State Department and Agency for International Development [AID], looking at the followup to the deployment of United States forces in Somalia and looking at the reconstruction efforts. It was very clear from the discussions we had at that time that mine clearance was the overarching priority. A similar situation faces Bosnia today.

The nature of the problem has already been described. I will, however—since humanitarian mining, which is our focus, is slightly different, I might provide a slightly different perspective.

The problem is that there are 110 million mines around the world, and last year the United Nations was able to clear 84,000 during a period when another 2 million or so are estimated to be laid.

Unfortunately, current methods for the detection and clearing of these landmines for humanitarian purposes are primitive, slow, dangerous, and expensive, and the problem is that donor agencies and international agencies cannot increase the funding for mine clearance to the level necessary to clear all these millions of mines with current methods, and so the answer has to come from significant improvements in the productivity of current approaches and from development of new technologies, and particularly for making these technologies more cost effective.

So over the past couple of years we have held two international consultations, recognizing that a great deal of the technology is being developed in other countries. I have included with my statement a list of the people and countries that we have been consulting with.

We hope to continue holding such meetings and to encourage international cooperation, particularly with counterparts in Russia and the former Yugoslavia, in the improvement of these technologies.

In the second meeting, which was held last week, the participants emphasized a number of general points, which I will review very quickly, concerning the context of humanitarian mine detection and clearance within which improved technologies should be deployed.

The first point is that the utility of detection and verification technology depends largely on good surveys, global information systems, maps, and photographs, to speed up and reduce the cost of employing detection techniques by reducing the need for either repeating searches or otherwise searching where it is not necessary.

Second, the technologies can most usefully be employed within a system of operational data reporting and sharing, as has been mentioned earlier. Resources should be allocated to ensure that the results from clearance efforts in various theaters can be entered in consolidated data bases currently being developed and these should be readily available through, for example, electronic networks.

The distinction between mines and UXO is often artificial, such as it is in urban locations particularly. This is true in Bosnia. Where appropriate, data bases for these two types of problems should be usefully combined.

Third, humanitarian mine clearance differs from military minefield breaching in that mine clearance requires as complete clearance as is feasible under economic constraints. However, much of the area clearance that is necessary in Bosnia is more similar to humanitarian mine clearance than traditional minefielding breaching in that roads and large areas may have to be cleared, not simply pass through mine fields.

Finally, there is need, the participants felt, for a mechanism to bring together the many organizations and agencies—national, international, governmental, private and PVO nongovernmental, and the private sector—to cooperate, coordinate, and exchange information in the interest of more effective efforts to rid the world of these land mines, and they felt that our modest efforts have been useful in that regard.

Of particular interest for Bosnia it was emphasized that geographic information systems [GIS] and multispectral scanning would be very useful in determining the areas that are not mined and to set priorities for mine-clearing efforts.

For clearance of roads which are suspected to be mined, primarily with antitank mines, vehicle, or aerial-platform-mounted metal detector arrays were named as being a very useful technology. Metal detectors could be backed up by radar, and vehicle-mounted thermal neutron analysis could be used for verification. It was also suggested that thermal imaging would be a useful technology to periodically patrol cleared roads and look for newly laid mines.

Dogs have been proven to be very effective in southern Africa and Afghanistan and could be used in Bosnia to detect antipersonnel [AP] mines on paths and trails as well as in urban areas, and hand-held metal detectors combined with radar, as was mentioned by some of the earlier presentations, to detect minimum metal mines could also be used in such areas.

It was also suggested that where there are large areas to be cleared, plows such as have been developed by the Swedish Bofer Co., could be used to destroy both antitank and AP mines, although there was a concern raised that if this is on farmland then the clearance of these areas down to 18 inches would effectively ruin the land for farming and developmental purposes, and, again, perhaps the MEDDS system and dogs would be more effective.

Top priorities for R&D that might be particularly useful, following very quickly, were indicated radar, particularly ground penetrating radar, as John Reingruber mentioned. Especially needed are improvements to hardware such as improved antenna design, greater bandwidth range, and making the equipment smaller and lightweight so it can be hand held, such as with metal detectors; second, fusion of different sensors and the data to improve recognition of mine anomalies and discriminate them from debris from explosions.

Next, longer-term research and development (R&D) priorities. There were two that were felt to be particularly useful: Careful experimentation to understand the mechanism by which dogs detect mines and explosives that might lead to more effective ways of deploying this particular technology and also the development of analytical devices based on chemical and/or biological sensing.

Second, thermal imaging could prove to be very useful for detection of mines with further study and development, including polarization filters, digital sensor processing and so forth, operational techniques.

I have included in my written testimony a table which gives a lot of these details.

I would simply close by saying that the two buzzwords which we have used, we have only heard one, and that was the "silver bullet." There isn't one. The second one is that what is required really is a "tool kit" that contains a whole variety of methods by which mines can be detected, and particularly for the humanitarian situation, that can be done much more cheaply and much more effectively with less false positives than they have at present.

Thank you very much, sir.

Mr. WELDON. Thank you, Dr. Dow.

I thank each of you for your testimony and for your commitment to helping us deal with this problem.

Let's open up with the first question. You have seen the commitment of the Congress made in the form of an addition of $13 million over the past 2 years for an enhanced effort in pursuing new technologies.

What has been the commitment above and beyond what has been allocated from within DOD itself? Have there been additional dollars that have been able to be garnered in here to assist you in your various efforts?

Mr. SINGLEY. If I might answer that, sir, if I understand the question. We, in the Army and the Marine Corps, as well as the multidisciplinary university research program that I mentioned, in 1994, we had about $26 million. With the $10 million the Congress gave us in 1995, that goes up to $38.2 million, and with the additional $6 million that we got in 1996, it goes up to $43.8 million, and that was the ramp that I was referring to in my testimony.

Mr. WELDON. OK.

Mr. SINGLEY. So you can see, it is a significant ramp.

If I could take a little liberty in answering your question also, sir. I think, oftentimes, people focus on how much money do we have going into advanced concept technology demonstrations [ACTD's] and advanced technology demonstrations [ATD's], and I think, as you heard from the National Research Council, this prob-

lem really deserves to focus on more than just that. We really need to work research in sensors, the same problem that one has in terms of sensor fusion, automatic target recognition. The same problem they have.

There are a lot of spin-off benefits, if you will, in our investments in other technology areas. So another part of the challenge is to make sure that we tap into that and stay current with those technological advancements as well.

Mr. WELDON. Dr. Dow, you just had your symposium. Dollar-wise, if you are advising the Congress now, what should we be doing to assist these fellows? They are all somewhat under the gun in terms of what they say because they are here in official capacities; you are not. Give us the scoop on where we should put the dollars. How much and what can be done if this Congress were to act in the near term? Because we are not talking about—it seems like we are always facing this issue when it occurs as opposed to putting the money out front.

What can we be doing now, if you have specific recommendations coming out of your symposium dollar-wise, to assist?

Mr. DOW. Thank you, Mr. Chairman.

I fear we do not have specific dollar figures coming out of our symposium. We were, rather, taking a rather preliminarily look at what the state of technology is and where priorities might offer better potential for future development.

I would say that I think—and this is my own personal opinion—there is not more—a great deal more money that would be required for the kind of research and development. I think a great deal of it is already going on.

I would like to see, however, that there might be certain additional resources provided to improve the level of consultation and the improvement of the information flow among the many organizations and agencies that are involved in this.

One of the problems which keeps coming up is that, particularly where one is dealing with the United Nations, where some countries, the military are very secretive about this. In other places, as in the United States, the military is not directly involved in it and one is dealing with private firms; there is very often a great deal of difficulty in finding out what other people are doing. One of the roles that we are interested in promoting by whatever way we can, is to increase the availability of information and the effectiveness with which it can be used on a real-time basis as theaters open up, such as has happened in Bosnia.

Mr. WELDON. Thank you.

One final question from me. I would ask of Mr. Singley, of Mr. Bachkosky: The General Accounting Office, as you know, did their report in September last year, and they made some observations that perhaps the coordination is not what it should be and that perhaps there was no clear strategic plan and that there was not a proper way to assess the dollar amounts that perhaps are being spent or would be needed to adequately assess the situation.

Now you have addressed the issue of the organization and what is underway. Are we now capable of establishing, or do we have a governmentwide strategy? Is that something that is in the works? And give us a status report on your response to the GAO report.

Mr. BACHKOWKSY. I believe it would be safe to say, Mr. Chairman, that there is an activity underway. In fact, it was formalized by Dr. Kaminski just recently to look at establishing a lead activity within the Department of Defense for countermine activity. This is something that will move at a fairly rapid pace and I believe will come to closure in the very near future.

I don't know if that answers your question, but we have put out a data call looking at all the potential sources who might lead this activity for them to come back in with their claim as to why, in fact, they might be most qualified to do this.

George, I don't know if there is anything you would like to add.

Mr. SINGLEY. Yes, sir. And in addition to that, we are trying to take a horizontal look across the relevant technologies in our Detailed technology area plan for conventional weapons, as well as the joint warfighting science and technology plan that I mentioned where we are trying to take a joint war fighters perspective in terms of what they need for the various tasks and missions.

So we are not waiting for all of that to come in. We are actually doing that, and we hope to have both of those updated this spring in time for the next budget bill.

Mr. WELDON. It is very important, and you can tell that by the interest here in Congress, that we are going to be very vigilant on this issue throughout this year, not just because of Bosnia, but because it seems to be a recurring thing wherever we send our troops, and we want to be on top of it.

Mr. SINGLEY. Yes, sir.

Mr. WELDON. Mr. Hunter.

Mr. HUNTER. Thank you, Mr. Chairman.

Gentlemen, you have discussed and it has been tough to take notes because you have gone through an array of technologies that are available and certain stages of development, and you have mentioned a number of agencies. The impression that you get is that there are thousands of people working this problem in various capacities.

I go back to an image that I saw on the television screen, which may or may not have been real, and that was one of—in the discussion in one of the news programs of the challenges facing our troops in Bosnia was the mine challenge, and in preparation for that, they had a bunch of GIs on their hands and knees probing with bayonets.

And the thrust of the story was, that is what they got, at least this particular unit, which would seem to indicate that there is a disconnect between all the king's horses and all the king's men and the poor old GI out in the field who is using what you folks are producing.

And Dr. Dow, I know I worked a while back on the Afghanistan problem and the various groups that were trying to introduce mine detecting equipment in Afghanistan. In the end, after we had a lot of great talk and a lot of fairly technical talk, we discovered that what they had was a little school with a bunch of people using rakes, garden rakes, to try to detect mines.

I guess my first question is, and maybe General Beauchamp—is it Beecham or Beauchamp?

General BEAUCHAMP. Beauchamp, sir.

Mr. HUNTER. Beauchamp. Good.

First, was that an accurate depiction on television that the basic infantry unit is still using bayonets to detect mines?

Maybe the best way to ask the question is: For your basic infantry unit, on the company level, what do you have in terms of immediate mine clearing capability? What are they equipped with in terms of being able to operate in a given area of operations and walk down a road or walk across a field in which mines are suspected to be located? What does a GI have?

General BEAUCHAMP. Yes, sir. To answer your question, the portrayal you related, sir, was not correct. We have provided the soldiers deployed to Bosnia with the AN/PSS–12, which is a hand-held mine detector, and in our experience, that is the best——

Mr. HUNTER. And what is that called again?

General BEAUCHAMP. The AN/PSS–12 hand-held mine detector.

Mr. HUNTER. OK.

General BEAUCHAMP. That is the best pulse induction metal detection system that we could find to deploy to U.S. Army forces.

Mr. HUNTER. That is metal detection?

General BEAUCHAMP. Yes, sir, that is a metal detector.

They have about 260 of those, which is the authorization in the units deployed to Bosnia, and we have additional equipment in the Army inventory, should it be required.

So those—those units are equipped with that fundamental piece of equipment, a very effective metal detection system.

Mr. HUNTER. That allows for about one detector for how many soldiers—to the platoon level?

General BEAUCHAMP. Sir, I don't recall the precise distribution. I can give you that information for the record.

Mr. HUNTER. OK.

General BEAUCHAMP. Because there is a distribution scheme.

[The following information was recieved for the record:]

DISTRIBUTION OF AN/PSS–12 MINE DETECTORS

Task Force Eagle has 261 AN/PSS–12 Mine Detectors on hand. There are an additional 1172 units available in V Corps should they be needed. Typical distribution of PSS–12's is 18 units per Engineer company and 12 per Military Police company. Armor, Field Artillery, and Infantry Battalions are typically authorized 2–4 detectors.

In addition, we have approximately 5100 of these systems available for issue in the wholesale supply system as of February 29, 1996.

The units deployed to Bosnia have their full complement of handheld mine detectors. They have not asked for additional equipment.

Mr. HUNTER. OK. So you have got a hand-held metal detector. Let's say, for cases of argument at least, a platoon leader would have at least one of those——

General BEAUCHAMP. Yes, sir.

Mr. HUNTER. For his point man.

General BEAUCHAMP. Yes, sir. And that is for area detection. It is hand held. It is not——

Mr. HUNTER. What does that do? If you are the guy with the metal detector and all of us in this room are in your company, and let's say the road is as wide as this room, what do you have to do to clear it as we go down it?

General BEAUCHAMP. Sir, you walk down the road, and you place the head of the detector as close to the target as possible, and I would note, under snow conditions and that sort of thing, the effectiveness can be degraded because it is sensitive to the distance of the detector head to the target.

But you would walk down over the target area and move the mine detector in front of you, and a signal is generated when metal is detected.

Mr. HUNTER. OK. Let me just ask you a question. If we are walking down—if everybody in this room is part of your platoon, and you are walking toward me, and you have got the metal detector, and people are spread out as wide as this room is—let's say that is how wide the road is—do you have to—do you have to slip the metal detector—have it basically ride over the mine before it will detect it?

How much do you, as the detection point man—how much do you have to cover physically with that thing, and how close do you have to get to clear it?

General BEAUCHAMP. Sir, you have to get fairly close with this particular detection system to detect the mine. Of course, we would deploy those probably in the situation you described with more than one soldier on the front to cover a broader area. You have to be fairly close. We have under development a system that would give us a stand-off capability.

Mr. HUNTER. OK. So what you could do?—Are you saying if you walk ahead, you can kind of—you can clear maybe a path that maybe you and George Singley could walk down, but you couldn't—you couldn't clear a path as wide as this room?

General BEAUCHAMP. No, sir, not with one detector.

Mr. HUNTER. OK. But you only have 260 detectors country-wide.

General BEAUCHAMP. In the forces deployed in Bosnia, yes, sir.

Mr. HUNTER. But how many people are deployed in Bosnia? I mean, it is a fairly large contingent.

General BEAUCHAMP. About 20,000.

Mr. HUNTER. How many?

General BEAUCHAMP. About 20,000, sir, as I understand.

Mr. HUNTER. OK. Well, you are not going to be able to have too many packages of multiple mine detectors to handle that requirement, I would think.

General BEAUCHAMP. Yes, sir.

Mr. HUNTER. With 260. But let me ask you—so that is what they have got. Now do they have anything with respect to plastic or nonmetallic mine detection for the average GI?

General BEAUCHAMP. Sir, the PSS–12 is the best system we have available. As was noted earlier today by Mr. Reeder, it does detect mines with a very small metallic content. That is the best system we have available now for those kinds of mines.

Mr. HUNTER. OK. Are some of these mines—now, the mines you have got out there, do they have—do most of them have some metal in them?

General BEAUCHAMP. Yes, sir. In our experience to date, they do have small metal contents in all of the mines that we have seen so far in Bosnia.

Mr. HUNTER. How effective is that on the nonmetallic mines ones that have small metal content to them, that have some metal in them?—this is strictly a metal detector, right?

General BEAUCHAMP. Yes, sir, that is true.

Mr. HUNTER. So if it is pure plastic, it won't detect anything?

General BEAUCHAMP. No, sir, this detector would not.

Mr. HUNTER. OK. How effective is it? If you are the minesweeper for a platoon, what can you do with the species of mines that are in Bosnia with this detector?

General BEAUCHAMP. Sir, it depends on the conditions. And I would also, if I may defer to my technical experts, if they should choose to elaborate on my answer, it is dependent on the conditions. If the conditions are good and dry and clear—the area is clear, no obstructions, not deep foliage—it is very effective because it is sensitive to the distance of the detector head to the target. If there is snow on the ground, then that could degrade the capability, the effectiveness of this system, because of the sensitivity to the distance between the target head and the target.

Mr. HUNTER. OK. Does a 6-inch snow eliminate the effectiveness of your detector?

General BEAUCHAMP. Sir, it would degrade it.

If I may, sir, let me refer to Dr. Heberlein.

Mr. HUNTER. Sure.

General BEAUCHAMP. Perhaps he could give us a more detailed technical answer to that question.

STATEMENT OF DAVID HEBERLEIN, U.S. ARMY NIGHT VISION ELECTRONIC SENSORS DIRECTORATE

Mr. HEBERLEIN. Mr. Chairman and other members, I am David Heberlein. I am from the Night Vision Electronic Sensors Directorate, which is part of the Army Material Command.

Mr. WELDON. Could you pull the microphone up so we can hear?

Mr. HEBERLIEN. Sure.

In our discussions with the Canadians, who have been in theater over the past year, they use the same type of mine detector that we do, the AN/PSS–12 detector. They state that they are able to detect all of the mines that they found in theater, the ones that have the small amounts of metal.

The good news is that, first of all, there is a small metallic content. It is aluminum, which is very susceptible to induction eddy currents. We are using a pulse induction type of detector which causes these types of currents to be induced in them.

So we believe that this type of detection technique, if it is used carefully, if it is used with all the training that General Gill was talking about, we will find the mines. But it has to be done carefully. Mr. Reeder also said with difficulty and with proper training.

Mr. HUNTER. OK. Let me ask you this: Are there any mines, species of mines, at all there, that are nonmetallic, totally nonmetallic? Are they all—I see a gentleman shaking his head.

Mr. REEDER. There are none, sir.

Mr. HUNTER. They are all somewhat metallic?

Mr. REEDER. Yes, sir.

Mr. WELDON. Would the gentleman yield?

Mr. HUNTER. Sure.

Mr. WELDON. Perhaps I am wrong. I thought I heard in the earlier panel that, in fact, there were some—the potential for some mines that have no metallic parts at all. Are you saying now that is not, in fact, possible?

Mr. MANLEY. May I answer?

General BEAUCHAMP. Yes.

Mr. MANLEY. Speaking for EOD, all of the mines that we know of in Yugoslavia—and we have—we published what we call an ordnance order of battle—they all have some metallic content. There are mines available to other countries that are going to be chemically fused, and they may not have any metal content.

Mr. WELDON. But we have no evidence of them being in theater?

Mr. MANLEY. Yes, sir.

Mr. WELDON. I thank the gentleman.

Mr. HUNTER. OK. Let me go back to what you have, General Beauchamp, and how it can be utilized by our troops, sir.

You basically have a mine that is a lot like—or a mine detector that operates somewhat like the metal detectors they use at the Manassas Battlefield, where you walk over ground and if something is very close to the head of that detector, they can detect it, the metal.

General BEAUCHAMP. Yes, sir.

Mr. HUNTER. We may have, due to the exigencies of this situation in Bosnia, the need to move troops rapidly. If this was a platoon in this room, and you had to move them quickly 2 kilometers away, and you had a road as wide as this room but you thought that there were some mines in this room, the only way you could safely move down it would be for you to slowly move down the road with—if you had a single detector using your detector and all the rest of us would have to fall in behind you single file and go in this very narrow area that you detected, follow your path, so to speak.

Now, as I understand it, the—we have under development presumably wider area detectors. So could you tell me what—what the next step is, what you would like to get in to allow for faster detection and wider area detection? I presume you have got something in the works there.

General BEAUCHAMP. Yes, sir, we do. And let me also say we have in Bosnia a vehicle-mounted mine detector to give us a better capability. That was the other part. We have one of those.

Mr. HUNTER. What does that do?

General BEAUCHAMP. Sir, that is a system that came from our science and technology base and we deployed to Bosnia. It has a metal detector with an infrared radar with a remote control kit that enables us to clear a larger area more quickly than we could with a hand-held detector.

Mr. HUNTER. What could it do?—if once again this hearing room was a road and we all had to follow you down there, what would the metal—the vehicularly-carried metal detector do? What would you do with it as a practical matter? Would it go a couple miles an hour?

General BEAUCHAMP. Yes, sir. It would go faster, with a broader area of coverage.

Mr. HUNTER. How wide?

General BEAUCHAMP. Sir, I don't recall the number. Let me ask, if I may. It is a vehicle width, sir. It has more than one detector on the vehicle, so it is the width of the vehicle.

Mr. HUNTER. So it has to drive almost right over the area?

General BEAUCHAMP. Yes, sir, on the road.

Mr. HUNTER. OK. So what it would do is, it would presumably clear an area. If you could clear an area that you and Dr. Milton could walk down with your hand-held detector, it would clear an area that perhaps John Bachkosky and George Singley and Dr. Milton and you could walk down, at least as wide as a vehicle or four abreast, right?

General BEAUCHAMP. Yes, sir.

Mr. HUNTER. But still it wouldn't clear an area—if you had a road as wide as a room, you couldn't clear that?

General BEAUCHAMP. No, sir.

Mr. HUNTER. OK.

General BEAUCHAMP. In a situation like that, what you might want to do is use rollers to clear a larger area, rollers that would detonate the mines as you move down the area.

Mr. HUNTER. OK. Now a question: How many of these vehicular-mounted detectors have we got?

General BEAUCHAMP. Sir, we only have one in country. We have a system under development now, but we only have one of these systems in country now.

Mr. HUNTER. OK. You have built one, at least?

General BEAUCHAMP. Yes, sir.

Mr. HUNTER. OK. What are the plans to get these—it sounds like—it seems to me like this is a marked improvement over what the average infantry platoon has right now with the hand-held system. What are your plans to get some more of those things ginned out and in country?

General BEAUCHAMP. Sir, we have a program in our development program. And if I may, I would like to give you a more detailed response to that for the record and tell you what our program consists of and how many and what we think the technology will do.

Mr. HUNTER. My question is: Are you trying to accelerate that and get them out as fast as possible?

General BEAUCHAMP. Yes, sir. It is a very important program to us for the reasons you have talked about before, and we would like to accelerate all of these technology programs where we can to give us an improved capability in Bosnia.

Mr. HUNTER. OK.

Mr. BACHKOSKY. Mr. Hunter.

Mr. HUNTER. Yes, sir.

Mr. BACHKOSKY. There are two comments I guess I would like to make. I have here a report that came out of Bosnia that is dated January 23 which goes through a fairly extensive discussion of the kind of training they perform, the equipment that they have, what that equipment is capable of doing. As General Beauchamp was indicating, it discusses the rollers, the plows, the antimagnetic mine activating devices [AMMAD] system.

[The following information was received for the record:]

VEHICLE-MOUNTED MINE DETECTION SYSTEM (GSTAMIDS)

As noted, we have built and provided a prototype system employing a metal detector and an infrared camera. We also have a long-term development program for a vehicle-mounted system. Under this program we enter a demonstration/validation phase in 1998 which would extend through 2000. A total of $13.3 million dollars is programmed for this phase. The Engineering Manufacturing Development (EMD) phase is scheduled to begin in 2001 and extend through 2003. A total of 41.1 million dollars is programmed for this phase. The production phase would begin in 2004 and could extend through 2010. 183.3 million dollars are programmed in production to acquire 308 systems. This is the program as it is currently constructed.

We are accelerating the vehicle-mounted mine detector effort to acquire a limited number of systems for deployment for Bosnia. We conducted one advanced technology demonstration in December 1995 and another in February 1996. These demonstrations employed Ground Penetrating Radars, Infrared Detection Systems and Metal Detection Systems linked to a satellite global positioning system and fitted with a paint spray marking system. In addition, we have issued a "sources sought" solicitation through the Commerce Business Daily to all segments of industry and academia for concept papers for a vehicle-mounted detection system. This solicitation closed March 11, 1996. Technical demonstrations will be conducted during the period March 18, 1996 to March 22, 1996. Those systems which demonstrate the required capabilities will be subjected to rigorous testing on an accelerated basis to ensure accuracy, reliability and performance. Those systems which qualify after technical testing will be subjected to a usage and validation test conducted by soldiers under conditions which replicate as closely as possible the conditions under which soldiers will use the equipment in Bosnia. These tests, under field condition, will provide the basis for development of training, fielding, and sustainment plans. This process, under normal circumstances, takes several years. We will accelerate the process to a few weeks after validation by soldiers. We will award a contract for delivery of a limited number of systems on the same accelerated basis for deployment to Bosnia.

The best estimate for delivery of this capability, assuming we can validate the performance before deployment is late summer to early fall. The rough order of magnitude cost is 20 million dollars for eight to ten systems.

There are just a whole series of them in here, and the indication we are getting is that this capability that is evidenced by what is there now is adequate to their immediate needs. But there is——

Mr. HUNTER. Well, as I understand, though, Mr. Bachkosky, if you get down to the platoon level, you are going to have platoons being deployed of 30 men and companies being deployed of 200 men. What these gentlemen have for their immediate use is a little hand-held metal detector like you use on the beach or you use out at Manassas Battlefield. That is what you have got right now.

Mr. BACHKOSKY. Yes, sir.

Mr. HUNTER. You have got that, and you have got your bayonet. So, I would disagree with you that that is adequate, because if you have to move out quickly, it is going to take General Beauchamp a long time to clear a little single-file area where people can follow him single file, much less in a spreadout configuration.

Mr. BACHKOSKY. General Gill, let me ask, is it not true that the—part of the Dayton Accords were that the 4-kilometer zone of separation was, in fact, going to be cleared by some point in time?

General GILL. That is a fact. The Dayton Accords requires them to clear the zone.

Now, the only issue then is how clear is clear? Do we trust warring factions?

Mr. BACHKOWSKY. We are sure to clear the zone.

Mr. WELDON. Would the gentleman yield?

Mr. HUNTER. Yes.

Mr. WELDON. That was supposed to have been done by the 19th, and we were led to believe that that date now has slipped. Do we know when that is going to be done by?

Mr. BACHKOSKY. I know it has slipped because of the bad weather and a number of other incidents, but I also know they are working toward it. And I believe, again, Mr. Hunter, that in addition to—once the zone is clear—and the indication is here that they are using the rollers and the other techniques to go through and assure that the clearance has occurred—that they then run helicopters in, I believe, on a routine basis to ensure that they detect any earth movement or anything that might have caused a replanting of mines.

Again, this is not 100-percent certainty, but I think that the move is in a direction that will give us—provide as much capability as we can.

The second point I wanted to make is, as I mentioned earlier, that both General Beauchamp and the people at ARPA are looking at those technologies that may, in fact, exist, and, again, I'll use the analog of the PREDATOR system that might, in fact, have application for either detecting or neutralizing metallic or plastic or wooden or any other kind of mine that may occur over there that might, in fact, be capable of being inserted in country, in a mode where our soldiers can use it both to detect and to neutralize systems.

So we are actively engaged in pursuing any options that might give us an enhanced capability over what we have today.

Mr. HUNTER. Well, listen, that is my point, and I think that is where we have to go.

Mr. BACHKOSKY. Yes, sir.

Mr. HUNTER. This, what I call a little coin detector, is really pretty pathetic, when you consider the incredible things we do with technology, and it is probably our fault. I mean if you get into the procurement and acquisition system and the R&D system, you understand why, you know, why Custer had single-shot weapons and the Sioux had Winchesters and Henrys.

Having this little single-file detector actually on hand for the GI at the bottom of the pile is terrible. I understand there are a lot of folks out there in the private sector. But also you have places like the "Skunk Works," where smart people can think up things.

If you put these in the hands of a couple of "Skunk Works" scientists right now and say. "This is what we have, we have a coin detector, can you guys help us and have it in 2 weeks." They probably could have something if somebody from the acquisition sector didn't come in and say, we have got to run this past my lawyers because I don't think we completed it.

This is something that is kind of funny in the discussion stage, but it literally is life or death to the GIs that have to walk down that road.

I guess what I would like to see, Mr. Bachkosky, is a little analysis in which, if you could provide for us, name what we have on the level—on the ground level in Bosnia right now, or anywhere else in the world. What do we have? What do we need? What do you think our needs are?

Maybe, General Beauchamp, you could help there. What is deployed? You have told me some of that. What are plans to deploy more? What needs to be developed?

In other words, if you take everything we have got in our inventory, even the vehicular-mounted one, and you figure we have got to do more, what needs to be developed in general terms, and what are our plans to develop it on an accelerated basis? If you could come up with those facts for the record, for this committee, we will do everything we can to help.

And I think we have been remiss in really addressing this thing. I mean, Afghanistan should have told us, when we ended up with a bunch of people with garden rakes in the United Nations putting these little classes on, that we didn't have what we needed. But it looks to me like we are pretty—pretty deficient here.

Mr. BACHKOSKY. Well, if I can, Mr. Hunter, make one other comment.

Mr. HUNTER. Yes, sir.

Mr. BACHKOSKY. And we will provide the information you are asking for, for the record.

[The following information was received for the record:]

INSERT FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
MILITARY PROCUREMENT SUBCOMMITTEE AND
MILITARY RESEARCH AND DEVELOPMENT SUBCOMMITTEE
THREAT OF LANDMINES TO U.S. TROOPS IN BOSNIA
January 24, 1996

PAGE #127/LINE #2937

.....

(The information follows:)

COUNTERMINE NEEDS AND CAPABILITIES

As noted earlier in this testimony, we have deployed 261 handheld mine detection systems to Bosnia. We have 1172 in Europe and approximately 5100 items in the wholesale inventory if additional systems are required. We have also previously discussed the deployment of one vehicle-mounted mine detection system employing metal detection and infrared sensors on a remotely-controlled truck.

The following table is a complete list of all equipment that has been deployed to Bosnia to provide an improved countermine capability. The list includes foreign systems, systems acquired from other services in the Department of Defense (DOD), systems under development and non-developmental systems off the shelf. (See attached charts)

The most critical need for Operations other than War such as Bosnia is stand-off mine detection, one that will enable us to detect landmines of all sizes and types with minimum risk to soldiers. The need for improved detection falls into three general categories:

- An Airborne Stand-off Mine Detection System. We need a capability suitable for mounting on an air platform such as a helicopter, fixed wing or unmanned aerial vehicle to detect, with a high degree of fidelity, mine fields and mine groups. The airborne system should incorporate the latest technologies in radar, infrared sensors and a high speed information processing system linked with a global satellite positioning system to give us the most accurate pin point locations of minefields and mine groups. Such a system would enable the development of strategies to map, avoid, clear or neutralize minefields and mine groups. An airborne platform would also enable the most effective engagement of ground based systems to pin point and neutralize mines in specific areas of operational interest.

- A ground Stand-Off Mine Detection System - We need a system that can be vehicle-mounted on a variety of platforms to give us an improved capability to sweep and clear roads at a rapid rate of advance. We must

incorporate the latest technologies in ground penetrating radar, infrared detection and metal detection coupled with high speed information processing systems. This system needs to be incorporated into a vehicle platform that is relatively impervious to mines with up to fifteen pounds of explosives. Also, a system that can be rapidly repaired in the event of a mine strike could be used. This vehicle platform should provide protection for these detection systems since the cost of these could range up to several million dollars per vehicle. These platforms should be remote controlled to provide maximum stand-off for soldiers engaged in mine detection operations.

- An improved handheld system. Currently, the best handheld system available is the AN/PSS-12 metal detector. We must develop and deploy a handheld detector which uses the most current technologies in ground penetrating radar, infrared and metal detection sensors. This new generation of handheld detection systems must provide a safe stand-off capability operations using it and detect mines of all sizes and types, with no metal content, in a wide variety of operating conditions.

We also need a capability to detect and neutralize off-route mines. This type of system should be capable of detecting and neutralizing mines planted in or along side roadways.

Clearing systems. We need to develop improved methods for clearing and neutralizing landmines in roadways and minefields or mine groups. Such systems should provide a capability to traverse mined area and be able to accept a mine strike of up to 15 pounds of explosives with full protection to the operator. This clearing capability should either be non-sacrificial or be capable of quick return to service in the event of a mine strike.

Vehicle protection. We need to continue development and acquire the best bolt-on armor protection systems for our tactical wheeled vehicle fleet. Wheeled vehicles are the work horses of an operation other than war and mine strikes against vehicles pose the greatest risk to soldiers moving personnel and cargo.

Minefield plotting system. We need the ability to digitally plot minefield and minefield groups once they have been detected by any of the means discussed above. This plotting system should produce high resolution maps and overlays and have a built-in capability to link with satellite ground positioning systems as well as a built-in capability to transmit from remote locations to a central data source.

Conclusion. These capabilities are critical for success in operations other than war, where we are attempting to determine the location of virtually all land mines in areas of operational interest. However, we also need an improved minefield breaching system for use in wartime operations. Improved capabilities for handheld and vehicle mounted explosive minefield and obstacle breaching systems are also required.

We established the Bosnia Technology Integration Cell in December 1995 to begin this effort. We began by developing an inventory of capabilities available from any source and coordinating with other Department of Defense (DOD) agencies and industry sources to identify the most promising technologies for deployment to Bosnia. The Technology Integration Cell has been expanded into the Army Countermine Task Force. This is a highly focused effort involving the materiel developers, research and development personnel, the user community representatives, other Services and Industry. As a first priority, we intend to accelerate the development and deployment of standoff mine detection capabilities. We plan to collapse the development cycle to months. Under the normal development cycle, this process could take several years. We have already begun the technology demonstrations of systems that we are aware of. We have solicited industry and academia through the Commerce Business Daily in a "sources sought" solicitation for the capabilities described above. We will conduct technology demonstrations, tests, and validate performance in the hands of soldiers under conditions as close to those in Bosnia as we can duplicate. However, we will not take short cuts on safety and deploy immature technologies that put soldiers who are using these systems at risk. Landmine detection and clearing, under perfect conditions with the most modern technology, is a very dangerous business. Soldiers have a right to expect that every reasonable effort will be made to ensure that we deploy the safest and most reliable equipment that technology can provide to conduct these dangerous operations. We intend to fully engage our partners in industry to find solutions to these daunting technological challenges in time to provide support to soldiers in Bosnia. If we are successful in developing capabilities that are effective and reliable, we will acquire these systems in limited numbers as quickly as industry can respond to our solicitation. We will use the experience gained in this effort to accelerate the development and acquisition of mine detection and protection systems whose programs currently extend beyond 2000 for type classification and deployment to all Army units who are authorized these types of equipment.

Item	Quantity	Current Status	Remarks
M1 Mine Rollers (1AD G4 working control of these)	30 o/h + 2 from 1ID (1 - NMC; and 1 - FMC)	25 in units and 5 in Lukavac/Tuzla; 1ID working on 1 NMC	All units have at least 50% of req'd rollers. Must finish cross-leveling. V Corps/DTO working to ship FMC roller.
M60 Mine Rollers	11 full sets and 2 right halves	11 rollers enroute to Bedrock	TFE scheduled to move to Bedrock on 26 Feb.

M60 Chassis	8 sent; 2 spares w/ turret @ GTA BOIP: 3-23En; 3-40En; 1-16En; & 1 Float	8 chassis enroute to Bedrock (unable to confirm departure or arrival at Bedrock).	TFE scheduled to move chassis to Bedrock on 26 Feb. New Equip Trng (NET) at Bedrock (16th En Bn)
Panther (M60 Robotic Controls)	3 with TFE; 4 at Slav. Brod	TFE kits on CEVs 4 on M60 Chassis (supposed to move 26 Feb to Bedrock)	Kaman has to manf. parts to move Panthers from CEVs. Prod. takes 7-10 days. 2 techs may return to US to pickup.
AMMADS (Anti-magnetic Mine Actuating Device)	18 - TFE; 12 - Taszar, HU; 22 - TACOM to procure.	18 - Tuzla 12 - Linehauled to Taszar (DCSLOG and V Corps checking)	*TFE located 12 AMMADS.* PM M/CM/D buying chains and shackles for USMC plow type AMMADS. Will ship over.
FECS (Field Expedient Countermine System)	4 with TFE 16 enroute	Mtd on M113s MWO by contract - coil; interface	FECS scheduled to arrive o/a 9 Mar in Tuzla with MTT from PM M/CM/D.
Miniflail (Robotic flail which clears a footpath)	2 (1 in Tuzla & 1 at Ramstein)	2 FMC Using flail (A/16E) (S&S art.).	Repaired miniflail scheduled to fly to Tuzla between 1-4 Mar. ULN: CAHHC12
Badger (Remote Control ST kit)	4 with TFE	Available	*Not using - No Vallon or similar system to use with Badger.*
Vallon (Veh. Width Mine Detector)	1 with TFE	NMC - Safety release pending	*Science Advisor working the safety release with CECOM.*
Infracam (Hand-held IR camera)	1 with TFE	Available	Limited by weather and technical problems
Pointman	2 (4 available)	3 @ Ft. Monroe; 1 @ USAES	EOD Teams will use for urban countermine ops.
Launched Grapnel Hook (Rifle)	200 with TFE	Available	*Not used yet. Limited use - clears footpath of tripwires.*
Mine Detection Dog Teams	6 MDDTs	Based in Tuzla.	*Won't complete in-country familiarization till mid-March.*
BASIC Body Armor	180 sets	Issued to Cbt Engr Bn Squads	*80 sets ea. - 23rd & 40th. 22 sets - 16th En Bn.*

MCAP (Dozer Armor Protection Kits)	12 o/h; 4 in rpr or transit; 6 to produce (need to req. 6 more).	6 in units; 6 at Tuzla; 3 transit to Dover to fly; 1 to repair	Prod: 3 kits avail. on 8 Apr. Need 3 more produced. (FMD msg requests 6 more). TFE looking at Tuzla Airfield.
5 Ton Armor Kit	326 Validated	2 on-hand in TFE 165 appr by HQDA for contract	DCSOPS-FMD working with V Corps on quantities
HMMWV Armor Kit	689 Validated	2 on-hand in TFE; 180 appr by HQDA for contract	DCSOPS-FMD working with V Corps on quantities
M113 Belly Armor	80	0 on-hand	Request at DA
Ballistic Protection Blankets	1330 Validated/ 3000 Req.	0 on-hand	Request at DA
Barret Sniper Rifle	2 on-hand	Available in TFE	240 rounds of ammo
M2 Mine Rollers	*24*	*V Corps validation packet to G3 & UR-FMD*	*Manufacturer: Pearson Engineering, UK.* **EDD- May 96**
M2 Surface Mine Plows	*24*	*V Corps validation packet to G3 & UR-FMD*	*Manufacturer: Pearson Engineering, UK.* **EDD- May 96**
Multi-sensor (GPR/Induction) Handheld Mine Detector	*2*	*V Corps validation packet to G3 & UR-FMD*	*Already discussed with ARPA and PM Countermine.* **Prototypes need work. EDD - Jun 96**
Titanium Mine Probes	*100*	*100 enroute this week**	*V Corps validating. * Per A. Pindle, 24 Feb, enroute.*
Blast Resistant Footwear	*20*	*To be shipped in next 2-3 weeks*	*V Corps validating. Per A. Pindle, 24 Feb, working.*

Mr. BACHKOSKY. But one of the things that I again mentioned earlier is the countermine ACTD that we are working on. One of the things that we are attempting to do there—and General Beauchamp's group is actively engaged in looking at those technologies—is that when you tie them together in a synergistic way may, in fact, give us a significantly enhanced capability over what we currently have. We have been able to miniaturize electronics; we have been able to miniaturize computers; we can look at signal processing, or automatic signal recognition systems, if you will.

Mr. HUNTER. Say those again.

Mr. BACHKOSKY. We are looking at our ability to tie together signals from various sensors that may be used in a synergistic way to give us a greater indication that mines are out there.

Mr. HUNTER. Now, what do you mean by that?

Mr. BACHKOSKY. The fact that we have been able to miniaturize electronics, for example, that may permit us to put in an automatic pattern recognition, and I am going to use that term rather than a target recognition: a means of automatically having a system that would indicate that there is an anomaly, even if it were only four-tenths of a gram of metal, which today we have difficulty pulling that out of clutter which is——

Mr. HUNTER. These ACTDs that you have are demonstrations. They are quick technology demonstrations; they are promising technology, right?

Mr. BACHKOSKY. Yes, sir.

Mr. HUNTER. OK. What have you done with this? Have you had a demonstration yet of this sensor technology?

Mr. BACHKOSKY. No, sir. Where we stand today is, the ACTD is pulling all of these technologies together and we will demonstrate that in fiscal year 1997.

Mr. HUNTER. OK. Now my second question——

Mr. BACHKOSKY. Do you want me to go on further?

Mr. HUNTER. But let me ask you a second question while I am on this ACTD, because you talked about that quite a bit. That is a fast demonstration of promising technology.

Mr. BACHKOSKY. Yes, sir.

Mr. HUNTER. You have a lot of companies out there, I understand, that have nonmetallic detectors, that they—nonmetallic detection technology that they like to—they would like to sell to you.

Mr. BACHKOSKY. Right.

Mr. HUNTER. Have you had any demonstrations, any ACTDs with nonmetallic demonstrations?

Mr. BACHKOSKY. I believe—and I will defer to Dr. Milton for that—I believe that a demonstration of the type you are talking about would be an advanced technology demonstration where we are really looking at the technical feasibility of a proposed approach.

Fenner, can you——

Mr. MILTON. Yes, sir. We have had an ATD, the close-in mine-portable detector, which has shown technology for nonmetallic mines. But that, of course, has been another kind of arrangement where the sensors, both ground-penetrating radar and infrared operating in combination, you needed to first find a suspicion of a mine and then go close to it to confirm it.

Mr. HUNTER. How close?

Mr. MILTON. It works again, with some probability of detection that needs to be improved against nonmetallic mines. But it doesn't give you a high speed of advance or large areas.

The stand-off detection capability that you, that we would all like to have, at high confidences, is an extremely difficult technical challenge. There are few, you know, single approaches that are—that are really available to tackle that.

Mr. HUNTER. How many——

Mr. MILTON. The best chance is really against minefields.

Mr. HUNTER. How many demonstrations have you had this year? How many ACTD's have you had with mine detection equipment?

Mr. MILTON. We had one ATD demonstration within the past year, which was this close in man-portable detector.

Mr. HUNTER. You just had one?

Mr. MILTON. Which tested several approaches. It was one demonstration, but several approaches and several different technologies for the detection of nonmetallic mines.

Mr. HUNTER. OK. Let me just give a suggestion, Dr. Milton. With the importance and the exigency of this situation, I would be out there having those doggone demonstrations just as fast as I could. I mean, I would have a couple of them a month. And if your technicians can't get the environment together for that, get some who can. Have an open house for people that want to come in and offer up their wares. Let them put their best foot forward and try to demonstrate what they have.

I mean, here we have a situation in which we could have people in real danger here within a few weeks. And you have had one of these vaunted demonstrations in the last 12 months.

Now, if you want to get technology into the field fast, let's quick-field it. The only way you can quick-field it is lots of demonstrations and lots of failures. Right? Let's put them on a high speed and get them them.

Mr. MILTON. We couldn't agree with you more. But the demonstrations that you can have in that variety, of course, are with equipment that has already been developed and that would be available at this time.

Mr. HUNTER. Well, let me ask you this: When somebody comes in—if you have a company that comes in that says, "We have got great mine detection technology,"—do you have a place where you can take them out and let them show their stuff right now? I mean, if not, why not?

Mr. MILTON. There is a facility just south of here in Fort Belvoir, that has lanes that are set up for testing, and we test all the time new ideas that come in.

Mr. HUNTER. Well, do you have an open house for people that want to bring their technology in? Because that is what I would have right now if I were you. If somebody has the answer, I wouldn't stand on ceremony. I would let them get into the facility, put them through the test, grade them, and if they have deficiencies, let them go back and work on it.

If they don't have deficiencies, if it looks like they might save a few lives or legs in Bosnia, well, get some prototypes whipped up

and at least get them tested. Maybe we can match the one vehicular detector that we have going to Bosnia.

We have one of those, right?

General. BEAUCHAMP. Yes, sir, and we have a program under way for an additional one.

Mr. HUNTER. My question: Do you have an open house for people to come in with this technology?

Mr. BACHKOSKY. Mr. Hunter, I know of no impediment for anyone in industry. In fact, I am sure that Mr. Singley, Dr. Milton, and General Beauchamp routinely get proposals coming in from industry who believe that they have the capability to countermine, or countersnipers, or addressed other issues that we have concerns about. And I believe that we have not raised obstacles to being able to test and validate that equipment.

Mr. HUNTER. What I am saying is, we have to go beyond, Mr. Bachkosky, not raising obstacles. I think you have to aggressively invite people to come in and have a system in which you can determine pretty quickly whether they have something or whether they don't have something.

Mr. SINGLEY. Sir, could I jump in here?

Mr. HUNTER. Yes.

Mr. SINGLEY. That was exactly the philosophy that we had behind trying to utilize the Jefferson Proving Grounds that was going to be closed. And, in fact, we received something like 40-some-odd proposals, and there were over 30 companies who were invited to bring their means for detection and remediation, their concepts, both airborne as well as ground and hand held. And we have been doing that over the last year.

That was the program I mentioned in my testimony where I said we took advantage of the Jefferson Proving Ground and all the buried ordnance that was there, and tried to create a controlled site.

The other thing I would like to mention to you is——

Mr. HUNTER. How many of them tested their systems?

Mr. SINGLEY. There were over 30, sir, over 30.

Mr. HUNTER. Different mine detectors?

Mr. SINGLEY. Different means of detecting buried ordnance, yes, sir.

Mr. HUNTER. Have you started to move any of those through the procurement system? I guess what I am saying is, you are doing this stuff presumably here. You have still got a GI out there with a coin detector.

Mr. SINGLEY. Yes, sir. The problem we had with that was, it just reaffirmed the problem that you have heard here on this panel today. None of them had acceptable false positive and false negative performance, and the highest—the highest probability detection, if you will, was with the systems that were closer to the ground, sort of like the concept that General Beauchamp was talking about. And so we do find ourselves technology limited.

And if I may, the principle that you are—that you are arguing is exactly behind the broad agency announcement, if I could just take a second to explain that to you.

Mr. HUNTER. Sure.

Mr. SINGLEY. Because I might characterize at least myself somewhat frustrated by this problem, after working it for a few years.

We have decided to go to a broad agency announcement which is out there on the Internet, inviting folks to respond. We are trying one more time to get whatever best ideas that we can get out there in industry and academia and to fund them at about $1 million a year.

Mr. HUNTER. OK. What is your level of detection? You say most of these systems came up to 70 percent, or some of them did?

Mr. SINGLEY. Yes, sir. The report for, I guess it was phase 2 or—the phase 2 report showed that the best performance we had was one system that was just under 50 percent probability of detection.

But the other piece of information, like you heard Dr. Dow talk about, which is important, is false positives and false negatives. It does you little good to have a signal that says, "OK, I have got something," and find out later that it was a false detection.

Mr. HUNTER. You mean a rock?

Mr. SINGLEY. Yes, sir. And this is one of the problems that you have with trying to detect buried explosives and mines, is they are not there in a pristine environment.

Mr. HUNTER. I understand that.

Mr. SINGLEY. It is a cluttered environment. There is metal in the ground.

Mr. HUNTER. We understand all of that.

Mr. SINGLEY. Yes, sir.

Mr. HUNTER. We also understand, with these incredible things that we do in other areas, like hitting a bullet with a bullet, the idea that you have got—the only thing that will work, that you can really rely on in 1996, is basically a coin detector. Having only this for infantry to protect themselves, is kind of tragic.

My question is: If you have a 50 percent or a 70 percent, can you take those and bring in our Nation's laboratories, which are all desperately searching for a mission, and maybe bring in the "Skunk Works" and see if you can't kick up that percentage to the rate that you are looking for?

What rate are you looking for? What is the milspec here?

Mr. SINGLEY. Well, there isn't any milspec here.

Mr. HUNTER. What is a percentage you would accept?

Mr. SINGLEY. The percentage, of course, in terms of the requirement, we get the requirement from the war fighter, but I think the percentage depends upon the task that you have.

I would imagine, if, for example, one is trying to survey an area and find out whether or not there are mines in that area, you might be able to accept, if it is an airborne survey, for example, a lower probability of detection and a higher false alarm than you would of course if you were the individual on the ground. There you want pretty much perfect detection, 99 percent, as you heard General Gill talk about.

Mr. HUNTER. At least maybe you could narrow it down. But I guess if you have got an area that has 100 mines in it, the 50-percent detection means you could probably find 50 percent of them, right?

Mr. SINGLEY. The other problem you run into is, you don't detect them, and then you have a casualty. I think——

Mr. HUNTER. Well, if I had a platoon of people and I had to move them across a piece of land and you could move them all single file

while General Beauchamp moves his coin detector in front of them, I would rather have the 50-percent detection than have nothing. Wouldn't you?

Mr. SINGLEY. Yes, sir. You heard we have a lower probability of detection requirement when we are breaching under fire.

Mr. HUNTER. I understand.

Mr. SINGLEY. If I could pick up on your point, sir, where do we go from here?

At the Jefferson Proving Ground demonstration, for example, there were Government labs, national labs, that participated in that. It was not just industry. And where we are going from here is, we are looking at the sensor fusion issue and how one fuses data and how you can reduce the false alarm rate. And I think that is a potential—a significant increase in terms of our capability.

Mr. HUNTER. I guess a lot of this is a challenge to our ability to focus on something and get it done.

Mr. SINGLEY. Yes, sir.

Mr. HUNTER. And, again, going back to Desert Storm, the systems that we developed and deployed in 14 days, we would still be working on them right now if we were working the general acquisition system and addressing problems that might crop up. But we told the "Skunk Works" scientists, we have to have this. So they went out and they did something that worked.

And I would just think we could beat the coin detector with these enormous resources that we can focus on a problem when it is a real problem. And now that the Bosnia situation has brought to the fore our mine detection problem.

I think we are all somewhat responsible for not having done more in the past. But this is going to require real focus and acceleration. Do not take no for an answer. Let everyone come in the door with their idea and at least look at it.

Mr. SINGLEY. Yes, sir.

Mr. HUNTER. That is what I would urge. I think if you come back for the record, with that memorandum—what we are doing to get that piece of equipment in the infantryman's hands—that would help us to at least know where we are at. Thanks for bearing with me.

Mr. WELDON. Mr. Kennedy.

Mr. KENNEDY. Mr. Chairman, I want to associate my concerns with those concerns already expressed by Chairman Hunter. I think that he mentioned that we need to move this into the procurement stage, and as chairman of the Procurement Committee, I know of his interest to get it into the procurement phase.

I think it would be helpful if we find out what is being done. Maybe we have set up some sort of report that we get, progress reports, with these panelists that perhaps within a time determined by yourself, Mr. Chairman, they would give us a progress report on moving forward some of these ideas into the actual procurement stage.

Mr. HUNTER. If the gentleman will yield, that is a great recommendation. I don't know, I think we have been picking on General Beauchamp pretty regularly. Who is the appropriate individual to let the committee know what the progress is on mine detection?

Mr. WELDON. Perhaps, Mr. Bachkosky, you could accept the responsibility. What would you estimate the time would be to get us something back in line with what Mr. Hunter outlined?

Mr. BACHKOSKY. Can I get back to you on that tomorrow?

Mr. WELDON. Certainly.

Mr. KENNEDY. Sure.

[The following information was received for the record:]

ACTIONS ON FIELD MINEFIELD EQUIPMENT

The Army published a "sources sought" solicitation in the Commerce Business Daily on February 2, 1996, "seeking sources who have technological solutions for detection of land mines of all types." The CBD solicitation closed on March 11, 1996. Technical demonstrations will be conducted during the period March 18, 1996 to March 22, 1996 at Fort A.P. Hill, Virginia.

Mr. John M. Bachkosky, Deputy Under Secretary of Defense for Advanced Technology is the appropriate individual to inform the committee on what the progress is on mine detection.

Mr. KENNEDY. I would like to also thank Chairman Weldon for holding this hearing.

I would like to ask those who want to answer, it seems to me we were in another period of time during the Vietnam War where this was initially of peak interest because of all the casualties we were taking in this area. What has happened since the Vietnam War?

It is sounding to me, with the answers that came in response to the questions asked to date, like we haven't made a lot of progress in what we have been able to field out there in terms of the technology. We have made progress in terms of how to integrate all the different information out there, but am I right to say the same technology we were sort of deploying in Vietnam is the kind of technology out there right now? Can you give us a little bit more explanation of what has progressed?

Mr. MILTON. In spite of its description as a coin detector, the APSS–12 has a significant advantage over what was deployed in Vietnam. You would never detect these low metallic content mines at all with the previous technology.

Mr. KENNEDY. We are in the same situation because now there are more plastic landmines out there, so now we are back where we were.

I think we also need to hear about the protection element, that seems to me to involve not only detection but clearance. Obviously marking is part of this, and protection.

It is important to keep in mind that all of this is part of it. We can't think that we are going to be walking a road when deploying troops along what is, you know, a footpath. We have got to think of what intelligence, as was mentioned by Mr. Dow, do we have out there already as to where the minefields are, how we mark them, what other things must be done other than detecting.

Can we just detonate it? Can we get it out of the way through rolling down a big tank of some sort to detonate anything in the way of these things? Because the end result would be the same. We would be protecting our soldiers. These are the kinds of things we need an update on, in addition to the detection part of it. Because the bottom line is getting it out of the way, whether we detect it

and deactivate it or whether we just blow it up to get it clear from our soldiers.

Mr. BACHKOSKY. That was the point I was trying to make earlier. We do have those kinds of capabilities, that range from mechanical flails that will go out and cause that kind of detonation, to rocket-propelled launchers that will go out and do the same thing, fairly long range, any distance.

It is difficult, I think, to articulate in very precise terms what our capability is, because we are dealing with a wide number of different types of mines that are buried and, I think as Mr. Reeder pointed out, are placed in different configurations, vertically, horizontally, with various kinds of trip mechanisms and fuses, and we are really trying to react to that whole thing. To say that we can or cannot do that is difficult because of the range, the variability, if you will.

I think that we can, as I said earlier, I think there are systems out this that give us the capability that we can improve on. There is no question there. I think, as Dr. Dow pointed out, there are some fairly sophisticated technologies, when you get into neutron activation techniques and others, that may in fact give us the ultimate capability.

What we are doing now is looking at how we might exploit by leveraging the various technologies that exist now, looking at sensor readouts in a synergistic way, to enhance our detection capability under a variety of conditions.

What we would like to do, as Mr. Hunter says, is to be able to drive through an area at flank speed, if you will, and do so with impunity because we know with certainty that either there are no mines or we were able to eliminate them. That is our ultimate goal. We are really pushing the technology, as Mr. Singley points out, with this BAA at the far end to do that, and we are looking at various techniques in between.

Mr. KENNEDY. One of the things that has not been lost on me in all of this—I think it goes to a point you were referring to—is you need good information, because if you do not have good information, you can't deploy. Whether it is protection, or detonation, all of that is contingent upon what the field looks like to you.

I think I want to get back to this, because it was my question to the previous panel, where our humanitarian efforts can become of incredible value to us in terms of getting that intelligence or global information system. You know, we are in Bosnia today, but we may be someplace else tomorrow.

If we are reaching out to areas that are littered with landmines and saying, "Let us get on the ground and help work with you on a management system by which you clear these mines," that helps us get all the information as to where the real trouble spots are, to begin to develop a cooperative relationship with the people on the ground, in-country, wherever it may be around the world that we may eventually be. That may be the next theater of action that we are talking about. Then when we get all of this great technology, we can deploy it effectively to the protection of our own soldiers.

So I agree with you, intelligence gathering from the get-go, our side needs to be exhausting all we can by whatever means possible

to get from everybody out there where the current mines are and the potential problems are, so that when we do get the technology, we focus it in the areas that it best can be utilized and deployed.

So I just wanted to add that, because in operations other than war that has been a constant area of consternation for this Congress and I know for the majority, an issue is what effectiveness do we gather out of spending money, you know, in a humanitarian effort when it is not a war. The fact is we are learning right now where that pays big dividends, because it seems to me there is no technology that gives you the 100 percent accuracy that we all want to tell us the mine is right there. So the best thing we can do from that point is use the information that has been given to us thus far.

Again, I want thank both Chairman Weldon and Chairman Duncan Hunter for the fact that they are taking the lead on this, because I think it is appropriate that we do that.

Mr. WELDON. Thank you, Mr. Kennedy. We appreciate you sitting through the entire hearing.

Mr. McHale, who has been there in recent times on the front line and observed some of the technologies that we employ.

Mr. MCHALE. Mr. Chairman, I thank you.

I apologize to the panel. I had two other hearings I was attending prior to this. Frankly, I missed most of your testimony. For that reason, my questions may not be as well informed as I would otherwise like them to be in other cases. The questions may have been more appropriate to the other panel, but if you can take a shot at them, I would appreciate it.

Clearing enemy minefields has been reduced to a tactical science, in terms of shooting the mine clearing line, blowing the lane, proofing it with the plow and all that good stuff. Is there any technological advance on the horizon that would dramatically alter that entire process? Are we on the edge of any technological leaps forward that would move to an entire systematic change in how we breach a lane?

Or are we looking, in the near future, from a technology standpoint, at incremental improvements in technology that would allow us to do what we do well a little bit better but essentially with the same technology? Would we breach a lane today the same way we did in February 1991, and do we anticipate that 10 years from now we would still be using the same system?

General BEAUCHAMP. If I may, sir, I will address the question. We do have systems under development that we think will provide us the proofing capability. The explosive standoff mine clearing system, for example, would give us we think an enhanced capability for a wide area that we think would be an improvement over today. That is on the horizon. It is not ready today. That is one system that I know would be very helpful.

Mr. MCHALE. If it does not touch on a security issue, and I understand if it does, what kind of time frame are we looking at for that operational capability?

General BEAUCHAMP. If I may, let me review the development schedules with more detail on that and give you where we are. In addition, the airborne stand-off mine detection system is a technology we are looking at, giving us ability to develop where mines

are, so we could develop a strategy to either avoid the minefield or clear it if necessary, or breach it if necessary to support combat operations.

That technology is on the horizon. It is very exciting. It is a fusion of some technologies we talked about earlier, so I think those capabilities that we are looking at, that are on the horizon, will give us this enhanced capability to clear and to breach that you speak of.

Mr. MCHALE. General, I thank you.

The second question probably would be more appropriately placed to the first panel of witnesses, and I apologize if it is inappropriately placed to you.

Could you give me briefly, a thumbnail sketch, what is the scope of our mission in Bosnia regarding mine clearing? To what extent are we proactively searching out minefields in order to clear them, primarily as a benefit to the permanent residents of that region? To what extent are we clearing minefields only in proximity of our troops for their personal safety?

[The following information was received for the record:]

OPERATIONAL CAPABILITY TO BREACH A LANE THROUGH A MINEFIELD

There are currently three systems in development that would change how we breach a minefield in the future. The first system is a man portable system which is being developed in a joint effort with the Marine Corps. This system is known as the Anti Personnel Obstacle Breaching System (APOBS). It consists of two backpacks containing a rocket propelled line charge with grenades on the line. It will create a path through wire obstacles and threat minefields. The system is scheduled for initial production beginning in Fiscal Year 1998 and will be fielded in the Fiscal Year 2000 timeframe. The second system is the Explosive Standoff Minefield Breacher (ESMB). This system is a rocket launched net with thousands of shape charge munitions at the nodes of the net. It is designed to clear a path 5 meters wide by 145 meters long by firing the shape charges into the soil to initiate the buried mines. Fielding of this system is expected to commence in Fiscal Year 2002. The final system in development is the M1 Breacher or Grizzly. The system is comprised of a full width mine plow and a telescopic excavating arm on an M1 tank chassis. The system is designed to have the same survivability as the M1 tank. A Low Rate Initial Production (LRIP) decision is scheduled for Fiscal Year 1998 and fielding is expected to begin in Fiscal Year 2000.

There is another technology that can be developed to give U.S. forces an added dimension for breaching threat minefields. The Off Route Smart Mine Clearance System employs multispectral signature reproduction technologies (acoustic and seismic), advanced threat signal processing emulations, low observable technologies and teleoperation to clear routes of smart side and emerging top attack mines. The use of teleoperation provides operator survivability. The platform for the advanced technology demonstration is a High Mobility Multipurpose Wheeled Vehicle (HMMWV) which provides a low cost, easily transported solution. This effort is currently not funded in the development cycle. With funding commencing in Fiscal Year 1998, a fielded capability could be had in 4–5 years.

Mr. WELDON. If the gentleman will yield, Colonel Barlow is here, and we will ask him to come up and he can go through it again.

Mr. MCHALE. Mr. Chairman, I do not want to inconvenience him.

Mr. WELDON. I think a quick response from him would be appropriate.

Mr. MCHALE. If it is not inconvenient.

Colonel BARLOW. The only mining operations that we are doing militarily are for the protection of the force. Now, there are some supporting type missions that when we have completed all of our principal missions, and in order to provide some security necessary to do the operations that the civilian side needs, the United Na-

tions side needs, they can make special requests. If we have the resources and if we are not bogged down with the principal activities, we can give some secondary effort to being able to do those.

But it is very clearly delineated what the three parties are responsible for and that the Uunited Nations DHA, along with our own transitional team, civilian team, receive basically from our civilian agencies, who will be working the other piece. We are trying to keep, in essence, the mission creep down, to keep our operational side of it completely free from the civilian side of it. This is going apace, and those kind of plans are being discussed in the Bosnia executive committee.

Mr. MCHALE. I expected that would be the answer. I wasn't sure that would be the answer to my question. I think it is safe to say, in light of the scope of our mission as we have defined it, this is going to be a pretty nasty situation still remaining in Bosnia when we redeploy at the end of one year. I think it is likely an awful lot of mines will remain buried and potentially dangerous in that nation.

Colonel BARLOW. I wanted to follow up on that one, as well. For the first time in a mission like this the reconstruction plan by the World Bank now includes $200 million earmarked for the humanitarian demining effort. Again, that hasn't been done before. They are collecting the moneys as we speak, so that effort isn't really going to get underway until perhaps, you know, later this year, but at least there is cognizance of the problem that you just mentioned, and there is indeed a 3-year plan to address it.

Mr. MCHALE. Gentlemen, I thank you very much.

Mr. Chairman, I thank you, as well.

General BEAUCHAMP. If I may add one thing for Mr. McHale, I would note the M–1 minefield breacher is the number one item on the priority list for the Engineer School. It is a breaching and clearing system. That is another system that we have under development that is very high priority for us, as well.

Mr. MCHALE. That is known as a last-minute plea to take note where you need some help. You kept a straight face. I noted your request. I think it is an area where we have an important responsibility to respond, because that piece of equipment will in all likelihood be used on some future battlefield.

Mr. WELDON. I thank each of you for your excellent testimony.

In bringing today's hearing to a close, I want to summarize and make some observations about what we have heard today from our witnesses.

Obviously the landmine threat in Bosnia is significant. I understand we have had 250 casualties for forces up until this time. There have been 12 allied casualties and one U.S. casualty involving land mines. We have heard Department of Defense has taken a number of measures to improve the capability of the United States forces to deal with the threat and carry out the mission in Bosnia.

I, too, am concerned about mission creep in this regard, and that is something we will be monitoring very closely. Nevertheless, we have heard that deficiencies do exist. Landmines which contain little or no metal, so-called plastic mines, are obviously difficult to detect and are a problem. However, we have heard there is no silver

bullet system or technology currently available that will provide a solution to the problem which would be near 100 percent detection with a near zero false alarm rate.

Historically, the U.S. countermine program is focused on breaching a landmine barrier, with little attention to technology and capabilities for area clearance. That focus continues today.

However, with examples of Somalia, Bosnia, and other Third World areas in which United States forces have been committed, it appears that increased emphasis needs to be placed on the development and procurement of area clearance technologies and capabilities in countermine and related programs. The area clearance problem is common to tactical countermine operations and to humanitarian demining. The technologies and capabilities developed for one are generally applicable to the other.

Countermine, unexploded ordnance and humanitarian demining programs in the Department of Defense are fragmented among several different agencies. Our understanding is at this point in time there is no single agency of the Department.

I have read one report where there are 21 separate departments and agencies of the Federal Government which have responsibilities in this area. Although we have heard today there are steps being taken to consolidate the responsibility, there is no such agency in the Department to which a user can turn to to address the issues or which has joint authority with regard to policy, doctrine and/or operational requirements in these closely related areas. Nor is there currently a single development activity with authority for oversight and management of each of these programs. I believe that these organizational programmatic issues need to be addressed by the Department, and we have stated that publicly today.

The attitude of the Department and the military services toward countermine programs I think is similar to an attitude we had toward chemical, biological defense programs in the past: When the threat is real, as chemical, biological and landmine threats were in the Gulf War and with the landmine threat in Bosnia today, we scrambled to get the force ready and provide increased funding as we seek new capability and new technologies to solve the problem.

In the times between conflicts, however, peacekeeping or other operations when the threat is not so immediate, we slack off on training, cut funding and reduce resource development and procurement. That cannot be allowed for the future, and this Congress has addressed this problem over the past several years.

Given the difficulty of the countermine problem, and for the countermine capability to be available when the troops are deploying, increased emphasis needs to be placed on the countermine program both from the standpoint of tactical programs and on demining. Short-term funding increases, such as those injected by the Congress and humanitarian demining programs, have limited impact.

Significant progress will only be made in the detection, neutralization, marking, clearance and protection when a focused, coordinated, funded and sustained program is established which addresses clearly defined operational requirements and incorporates the best efforts of government, industry and academia. We look to the

Department of Defense, the Secretariat, the Joint Staff and military departments to establish such a program, and you can tell from the tone of the questions here, we are going to be monitoring this very closely.

Gentlemen, we thank the members of both panels for your excellent testimony. We support what you are doing and encourage you to tell us how we can support you to go even further and quicker in supporting the long-term solution as well as the short-term needs to the problems confronting the troops in the field.

Thank you. This hearing now stands adjourned.

[Whereupon, at 5:35 p.m., the subcommittees were adjourned.]

Statement

from the

NAVAL JOINT SERVICE EOD TECHNOLOGY DIVISION

on the

"RESPONSE TO THE LANDMINE THREAT IN BOSNIA"

at a joint subcommittee hearing held by the

MILITARY PROCUREMENT AND RESEARCH AND DEVELOPMENT SUBCOMMITTEES

on

24 JANUARY 1996

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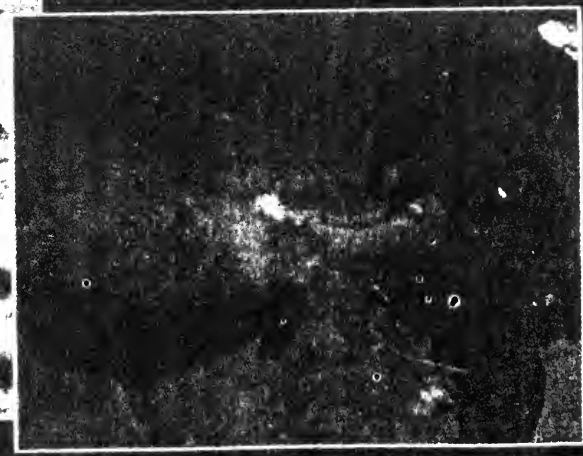

Part I. Background

❒ Good afternoon, I'm Dr. Claude Manley the Technical Director at the Navy managed Joint Service activity (NAVEODTECHDIV) responsible for providing military bomb disposal, Explosive Ordnance Disposal (EOD), technicians with the equipment and information used in the emergency neutralization of hazardous devices. We are part of the Naval Ordnance Center.

❒ The traditional role of all military EOD personnel is to find and neutralize "dud" or damaged explosive loaded munitions which are a hazard to operations and require a "one-on-one" response by a highly trained and experienced technical specialist. EOD also deals with terrorist improvised devices, explosive, chemical, radiological and nuclear.

❒ EOD technicians are not normally used to breach land minefields during an assault. Their numbers are too small (3352 in the four services, deployed world wide in small teams) and they are not trained and equipped to operate in contact with enemy forces. (Unique to the Navy, Navy EOD specialists are also divers and are part of the Navy's mine countermeasure system for naval mines). EOD technicians are routinely involved in the neutralization of ordnance and mines left behind by combatant forces. In the context of modern ordnance, the distinction between mines and improved conventional munitions is disappearing, and the traditional role of EOD is expanding to include wide area ordnance decontamination.

❒ The activities of the NAVEODTECHDIV support the EOD specific joint services requirements, part of which address ordnance detection. As part of our continuous assessment of useful technologies we manage an environmental unexploded ordnance (UXO) remediation program for the Army Environmental Center. This program funds companies to demonstrate technologies applicable to locating and recovering ordnance on military firing ranges, both active (Live Site Demonstrations) and formerly used (Jefferson Proving Ground). We are also providing technical services on site to support the contracting by the Navy for the cleanup of the Kaho'olawe Island bombing range.

Part II. Mine Countermeasures Technology Summary Statement.

❒ The detection of anomalous objects in soil is a difficult technical problem. In WWII mines were made of metal and this feature was exploited by developers of mine detection equipment. Low signature mines (hand crafted shoe box mines) were first used against U. S. Forces during the Korean conflict. In 50 years improvements in manufacturing technology have made possible the high volume, low cost production of low signature mines. Although of limited usefulness now, metal detectors will have an almost non existent mine countermeasures utility in the near future.

❒ The technology is available to support engineering development of a hand held, active metal locator with about five times the detection range, in non conducting soil, of the present family of military locators and mine detectors. This translates into at least an order of magnitude (that is, 10 times) improvement in capability to detect a small metallic mass at a fixed range. Such a detector would cost more by a factor of 3 to 5 and weigh more by a factor

of this locator in quantity would be three or four times the present cost of mine detectors.

Part III. NAVEODTECHDIV Research and Development Technologies.

❒ NAVEODTECHDIV develops and purchases ordnance locators for use on land and in the ocean. Since the majority of ordnance is metal cased, or contains significant quantities of metal, our development focus has been on magnetometry (passive detection of ferrous materials) and low frequency electromagnetic induction (active detection of conducting materials). At present EOD uses operationally two passive and one active hand held locators.

❒ NAVEODTECHDIV has in development for a number of customers the following projects with some long term applicability to the mine countermeasures problem and of only limited usefulness to the immediate problem in BOSNIA:

--SOCS (an autonomous multi sensor ground survey system) (Army Environmental Center)

--RECORM (a small, 80 lbs., remotely controlled reconnaissance system) (Joint Service EOD Program)

--Autonomous RECORM (autonomous search for ordnance) (Unmanned Ground Vehicle Program)

--BUGS (multiple, low cost, extremely small, unintelligent robots designed to forage for scatterable munitions as a cooperating colony, or to self destruct over mines) (Office of Naval Research) (Marine Corps)

--HTS/SQUID (a hand held, extremely sensitive magnetometer) (Office of Naval Research)

--ADPULSE (a hand held, advanced technology pulse induction device) (Office of Naval Research)

--Geometrics EM-61 (industry standard geophysical survey instrument) (Kaho'olawe cleanup)

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